Electrical Contracting

THE MAGAZINE OF ELECTRICAL CONSTRUCTION AND MAINTENANCE

SEPTEMBER

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NDUSTRIAL

LECTRIFICATION

ECTION

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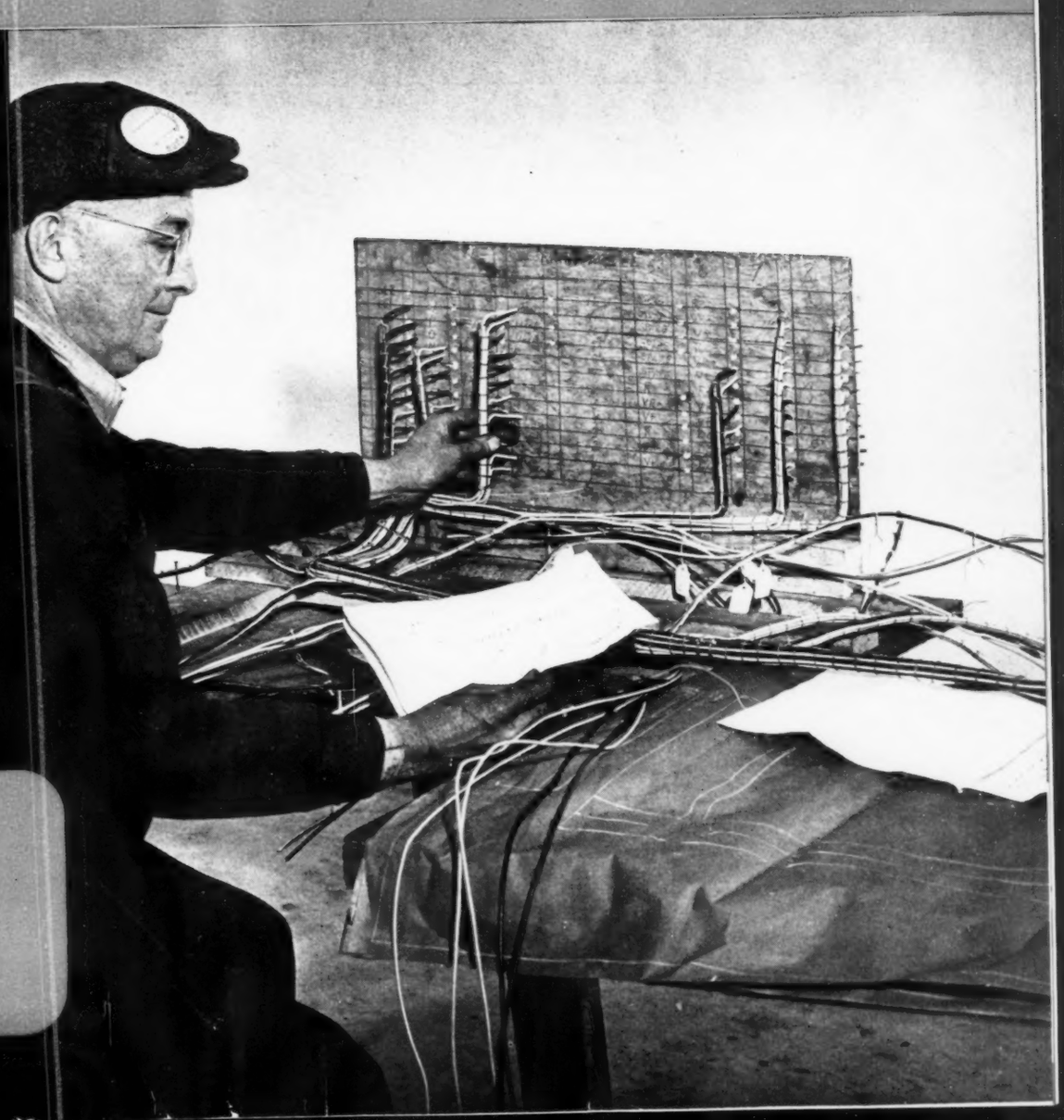


For REMARKABLE SAVINGS in LIGHTING WAR PLANTS

Does *twice* the work—yet costs the same as *one* Tulamp 100-watt ballast

USE THE NEW G-E FORLAMP BALLAST

FLUORESCENT lighting fixtures cost less, weigh less, and use much smaller amounts of critical materials when equipped with these new ballasts because *one* G-E Forlamp ballast will operate *four* 100-watt fluorescent lamps—a job that previously required at least two Tulamp 100-watt ballasts.

Compared with two Tulamp 100-watt ballasts, the new Forlamp ballast uses 48 per-cent less copper, 47 per-cent less iron and steel, and 50 per-cent less aluminum. Because it is priced exactly the same as one Tulamp ballast, you get, in effect, two ballasts for the price of one, a saving of 50 per-cent.

Saves Copper in Plant Circuits

Circuits carrying power at the higher distribution voltages require much less copper than circuits carrying the same amount of power at the lower voltages ordinarily used for lighting circuits. For example, when a given amount of power is distributed at 115 volts, 4.6 pounds of copper per foot is required, whereas only 1.4 pounds of copper per foot is required when the same amount of power is distributed at 265 volts.

The new Forlamp ballast operates within a voltage range from 250 to 280 volts, from power supplied by a Y-connected circuit either 254/440 volts, 265/460 volts, or 277/480 volts.

Many new war plants—particularly those with load-center distribution systems—have circuits carrying power at the higher voltages (between 250 and 280 volts). In most cases plants converting for war production can easily provide the proper voltage for operating the new Forlamp ballasts on their lighting circuits.

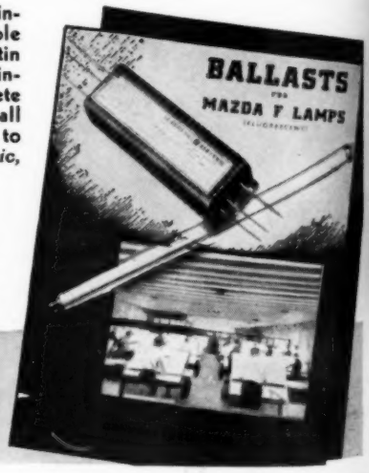
Savings in Power

Electrical losses in a Forlamp ballast are 46 per-cent less than the losses of two Tulamp ballasts. This makes possible the operation of four 100-watt lamps at rated lumens of light output with 8 per-cent less power consumption.

In one large bomber-plant lighting installation, this has meant the release of 303 kilowatts of power for other uses.

Write today for complete information on this remarkable new ballast. Ask for Bulletin GEA-3293D. It contains information on the complete line of G-E ballasts for all MAZDA F lamps from 4 to 100 watts. ***General Electric, Schenectady, N. Y.***

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment



GENERAL ELECTRIC

498-8-5206

For the mounting of cables in manholes—vaults, in service boxes or on station walls—whether the job calls for a light or heavy duty rack, porcelain insulated or not—you can rely on Murray Racks to meet the requirement.

These racks are designed to combat corrosion and make replacement unnecessary—they permit the interchange of arms with least effort—they are easy to install—and any required spacing between cables can be provided. Bulletin 103 gives details.

METROPOLITAN DEVICE CORPORATION, 1250 ATLANTIC AVE., BROOKLYN, N. Y.

MURRAY CABLE RACKS

INSTALL ONE unit . . . DO 4 jobs

WITH WESTINGHOUSE COMBINATION LINESTARTERS for a-c motor circuits

Size 1 Combination Linestarter, Class 11-206

Westinghouse Nofuze Circuit Breaker

1 ACTS AS MANUAL DISCONNECT SWITCH. Locking arrangement permits padlocking cabinet closed and switch in off position. Eliminates need for separate switch. "De-ion" arc quenching protects contacts.

2 PROTECTS CIRCUIT AGAINST OVERLOADS. Bi-Metal gives positive protection against short circuits and severe overloads . . . does away with need for fuse equipment. Unvarying — factory-calibrated — self-indicating.

Westinghouse "De-ion" Linestarter

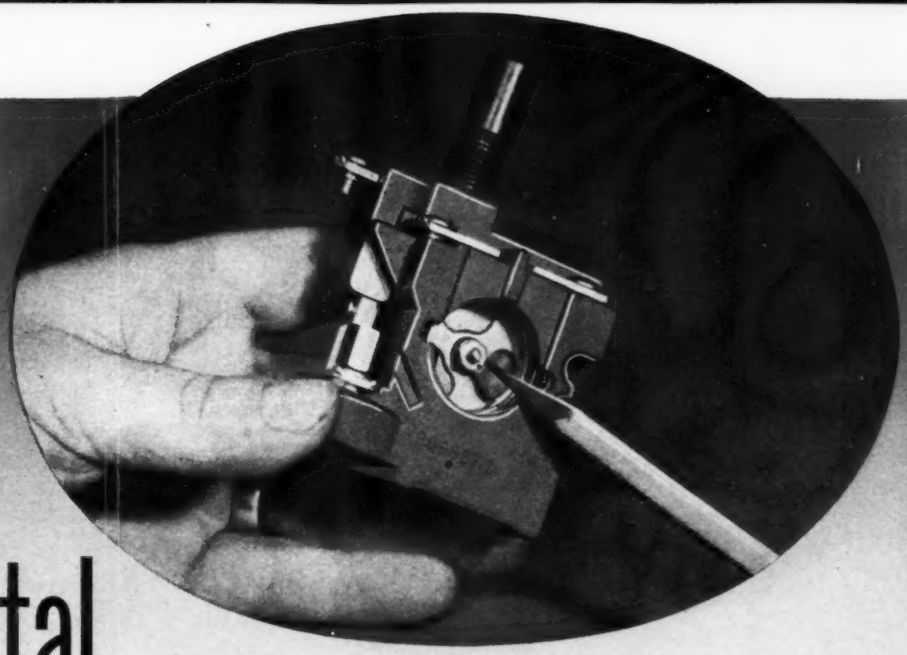
3 GIVES MAGNETIC ACROSS-THE-LINE STARTING. Permits operating motors by push button, float or pressure switch. Contacts opened and closed by direct-acting, vertical solenoid magnet. "De-ion" arc quenchers protect contacts.

4 PROTECTS MOTOR AGAINST OVERLOADS. Bi-Metal relay calibrated to protect motor permits momentary overloads as in starting, but protects motors from sustained overloads.

Save wiring—save time—save space! This single "package" contains everything you need for the motor circuit in one compact, easily installed enclosure.

Westinghouse Combination Linestarters combine the advantages of Nofuze Circuit Breakers and "De-ion" Linestarters. They eliminate delays for fuse replacements, and simplify the job of providing proper control and protection for motor circuits. Specify them . . . install ONE unit—and do FOUR jobs! Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Westinghouse



Disc type Bi-metal protection as used in Westinghouse Motor Starters. Bi-metal disc is composed of two metals with different rates of expansion, bonded together. When heated by overload, the disc snaps, opening the circuit. Bi-metal protection is unvarying—has nothing to wear out or replace.

Bi-metal PROTECTION . . . A WESTINGHOUSE FEATURE

THAT MEANS ADDED PROTECTION FOR VITAL CIRCUITS

Motor or circuit protection that operates when it doesn't need to, means unnecessary production delays to replace fuses or restore service. Protection that is prevented from operating when it should, means even more expense in damaged motors or machines.

BI-METAL protection—a Westinghouse development—solves both problems. It acts with uncanny accuracy to permit temporary overloads, as when motors are started across the line, yet snaps the circuit open with rifle-bullet speed when short circuits or dangerous overloads occur. Factory-calibrated, it can't be tampered with or held closed against short circuits.

BI-METAL is a basic protective feature of Westinghouse motor starters and circuit breakers—you get it at no extra cost. Use it for the added, accurate protection it affords—specify Westinghouse protective and control equipment.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

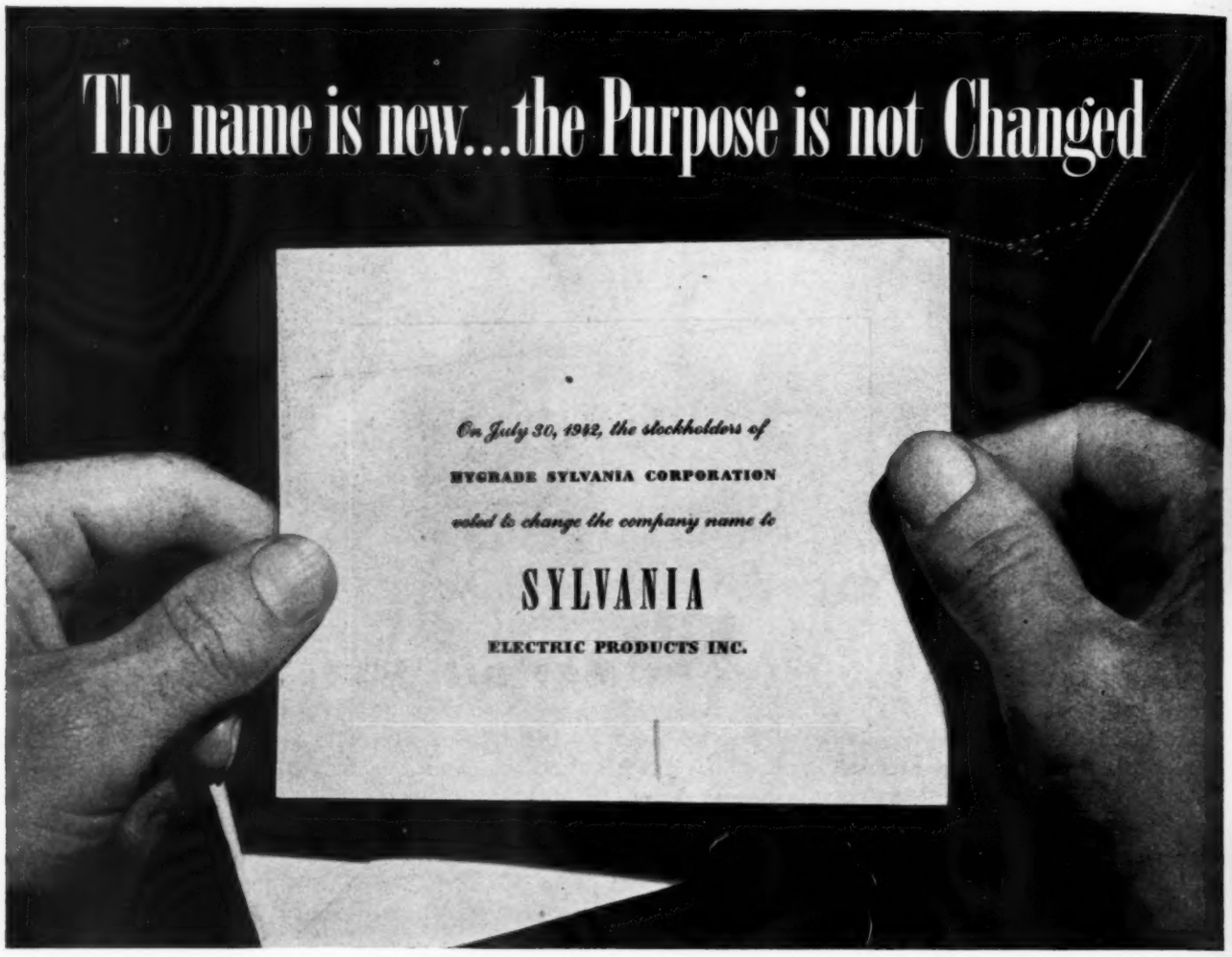
J-21186

"DE-ION" COMBINATION LINESTARTERS MEET JOB REQUIREMENTS

Motors and Control

WESTINGHOUSE

The name is new...the Purpose is not Changed


On July 30, 1942, the stockholders of
HYGRADE SYLVANIA CORPORATION
voted to change the company name to
SYLVANIA
ELECTRIC PRODUCTS INC.

● There's little in a name beyond what men put into it by their sincere effort and their determination to give it significance.

There has been a great deal, though, in the name Hygrade Sylvania because of the high standards that have marked the manufacture of its products—Hygrade Incandescent Lamps, Hygrade Fluorescent Lamps and Fixtures, and Sylvania Radio Tubes.

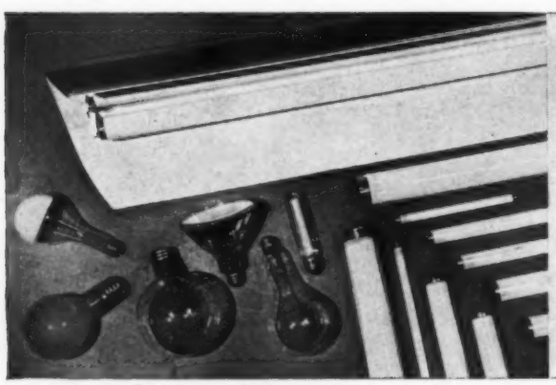
But there are advantages in simplicity, and in a single title that stands for single-minded insistence on the highest quality possible in any field with which it is linked.

So as of July 30, the name of the Hygrade Sylvania Corporation, adopted in 1931, became Sylvania Electric Products Inc.

Largely as a matter of conserving stocks of cartons and scarce packaging materials, changes in the trade names of Hygrade products will be made gradually.

Eventually, however, all products of the company will take the name *Sylvania,* which will become the single emblem of our one and unchanged purpose to produce the best in our field and to make our products widely known.

You who have known the quality of Hygrade Lamps and Sylvania Tubes will continue to find that same superlative quality in those products. The only change will be in the name, to which we intend to add new luster at every opportunity that is given us to improve on the quality and performance of our products.



Hygrade Incandescent Lamps, Fluorescent Lamps and Fluorescent Fixtures have established themselves by the quality which has always been held at highest standards. These quality standards will remain unchanged, but gradually, as present stocks of cartons and scarce packaging materials are used up, their trade name will be changed to Sylvania.

E. J. Poor.

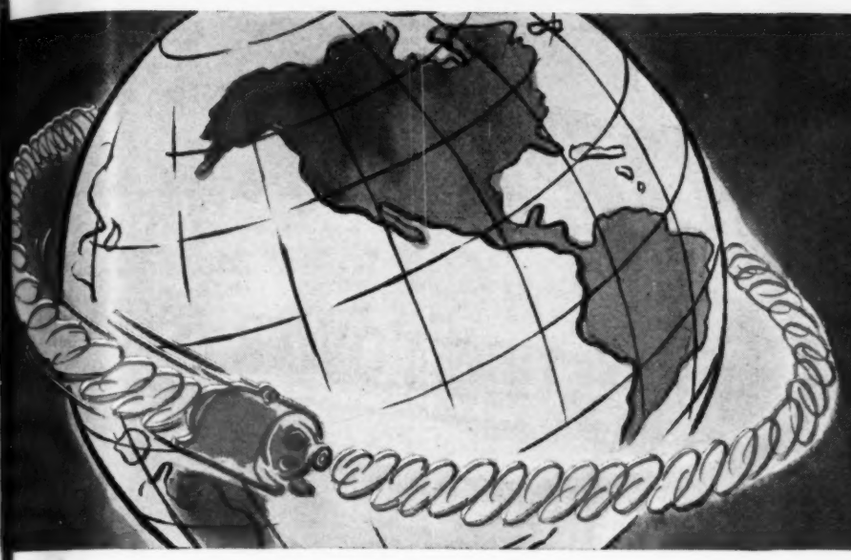
CHAIRMAN

SYLVANIA ELECTRIC PRODUCTS INC.
Salem, Mass.

Hygraae ..ncandescent Lamps, Fluorescent Lamps, Fixtures and Accessories, Sylvania Radio Tubes

ELECTRICAL CONTRACTING. Published monthly, price 25 cents a copy, Vol. 41, No. 9. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Electrical Contracting, 330 West 42nd Street, New York, N. Y. Subscription Rates —U. S. A., and Latin-American Republics, $2.00 a year, $3.00 for two years, $4.00 for three years. Canada $2.50 a year, $4.00 for two years, $5.00 for three years. Great Britain and British Possessions 18 shillings for one year, 36 shillings for three years. All other countries $3.00 a year; $6.00 for three years. Entered as second-class matter August 29, 1936, at Post Office at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. Copyright 1942 by McGraw-Hill Publishing Company. Cable address: "McGrawhill, New York." Member A. B. P. Member A. B. C.

Wartime Problems



ROUND THE WORLD EVERY 8 DAYS!

That's the rim-travel of a rotor in many electric motors now working all around the clock on Victory production!

Motors that worked 1800 hours in a peacetime year are now working a full *8700 hours a year*. Result: problems of maintenance are *quadrupled*. And more...

For motors must receive *finer* care than ever. Whose motors last longest may have a lot to do with who *wins* this war!

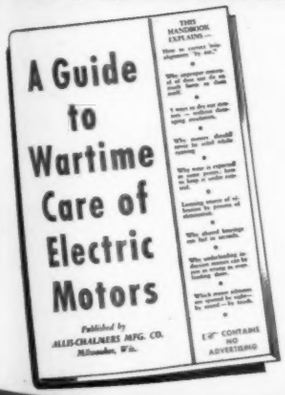
CALL FOR Wartime Solutions

AN ATTACK IS THE BEST DEFENSE

Taking the initiative against wear always has been sound maintenance practise. In wartime, it's a *vital* practise!

First, because wear now works *faster*. Second, because avoidable breakdowns *cannot be afforded* in the victory effort!

Beating wear to the punch is the basic principle of a new Allis-Chalmers publication: "A Guide to Wartime Care of Electric Motors." You'll find it *invaluable!*



Order This Free Book!

Every engineer, production manager and maintenance man will want a copy of "A Guide to Wartime Care of Electric Motors" for his technical library—and for immediate use, too!

It outlines the "natural enemies" of an electric motor and the most effective methods of combatting them. To be of maximum use to you, it applies to *all makes* of standard, general-purpose motors.

It's liberally illustrated — contains no advertising.

Tear out the order form now and send in to Allis-Chalmers for *your* free copy of this timely handbook.

ALLIS-CHALMERS MFG. CO.
Advertising Dept.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive *free of charge* "A Guide to Wartime Care of Electric Motors."

Name:.....

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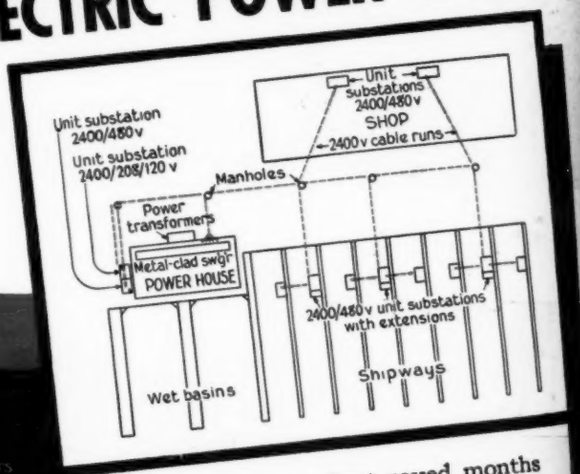
ALLIS-CHALMERS

MILWAUKEE·WISCONSIN

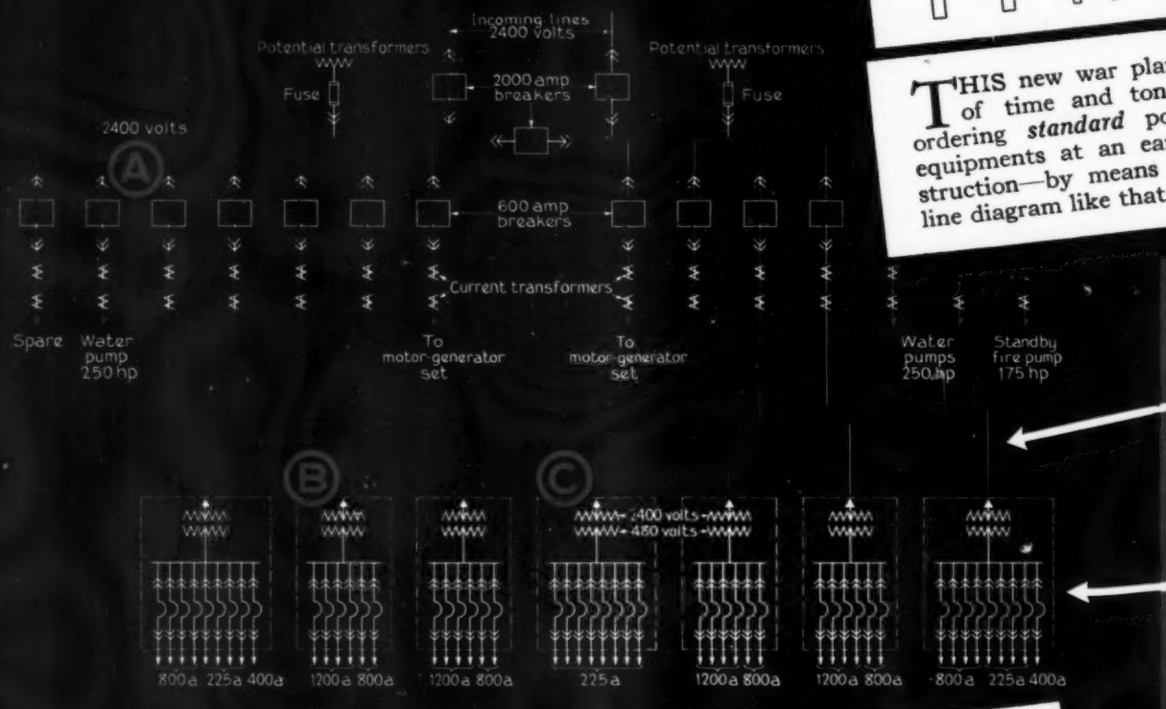
WE WORK FOR VICTORY — WE PLAN FOR PEACE

1/4 THE TIME 1/7 THE COPPER

AND A BETTER ELECTRIC POWER SYSTEM



THIS new war plant saved months of time and tons of copper by ordering *standard* power distribution equipments at an early stage of construction—by means of a simple one-line diagram like that below.



Power is distributed at high voltage right to unit substations at the load centers—

—from where it is distributed at 480 volts directly to the loads.

Many war-production factories are ordering plant distribution equipments at an early stage of construction by taking these three simple steps:

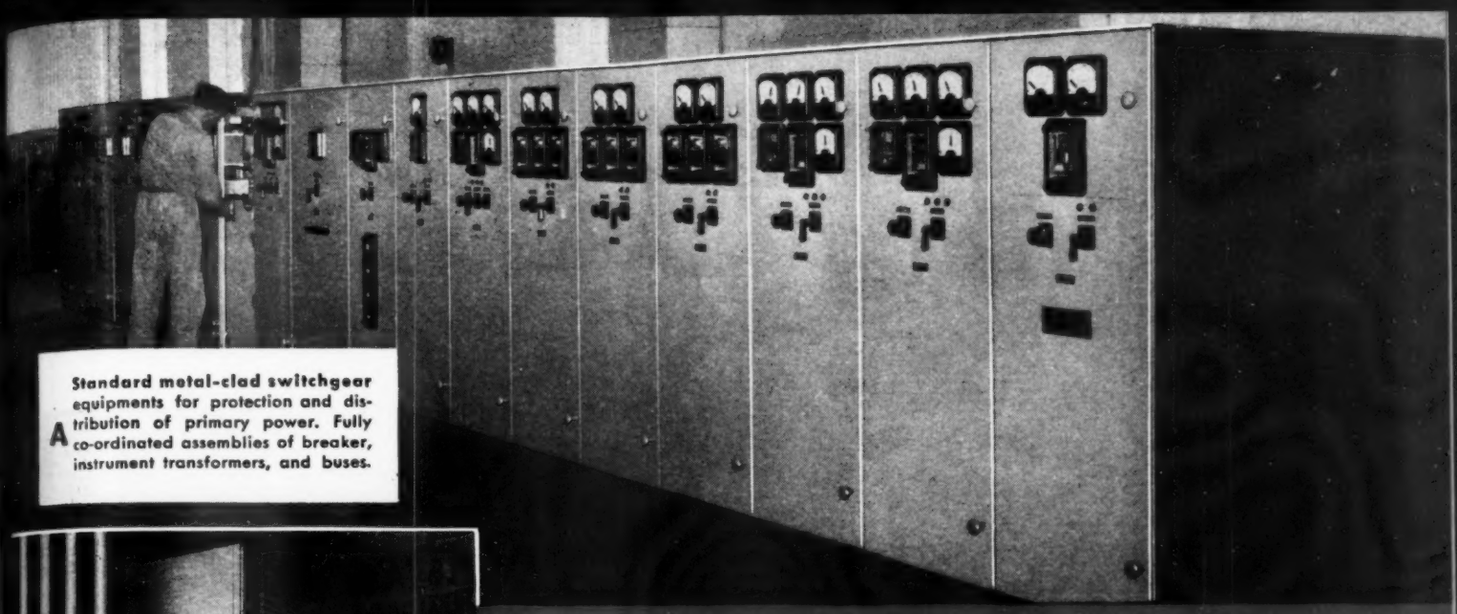
1 *Calculate the total kva you need.* Your consulting engineer can help you to determine this accurately.

2 *Divide the load area into separate load zones of 500, 750, or 1000 kva each.*

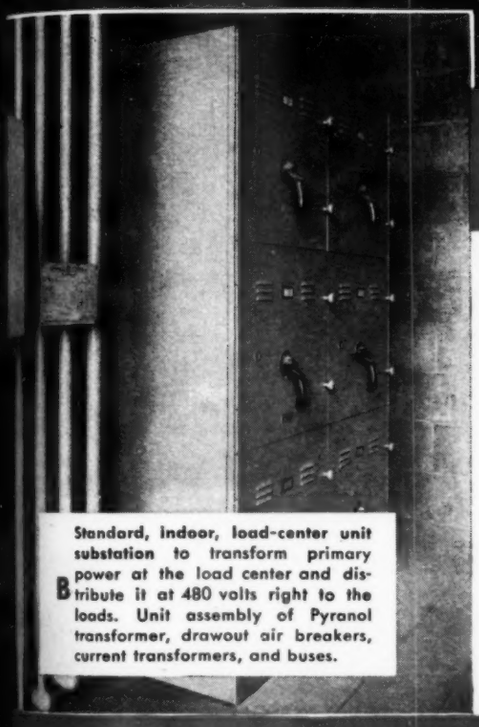
3 *Divide the load of each zone into feeder loads,* and draw a one-line diagram of your proposed load-center system, giving the functions to be performed and the ratings required. *With this one-line diagram you can immediately order standard G-E switchgear equipments and unit substations.*

For further aid, ask for our new bulletin, No. GED-1006.

The Navy "E", for Excellence, has been awarded to 92,700 General Electric employees in six plants manufacturing naval equipment.



A Standard metal-clad switchgear equipments for protection and distribution of primary power. Fully co-ordinated assemblies of breaker, instrument transformers, and buses.



B Standard, indoor, load-center unit substation to transform primary power at the load center and distribute it at 480 volts right to the loads. Unit assembly of Pyranol transformer, drawout air breakers, current transformers, and buses.

MONTHS SAVED BY ORDERING STANDARD EQUIPMENTS

STANDARD G-E load-center power units were ordered for this war plant soon after construction started. A simple one-line diagram like that at the left put our factory right to work. Metal-clad switchgear and unit substations were installed in *one-fourth* the time needed for non-standard, piecemeal assemblies. They were received at the job when needed—all ready to be set in place and connected.

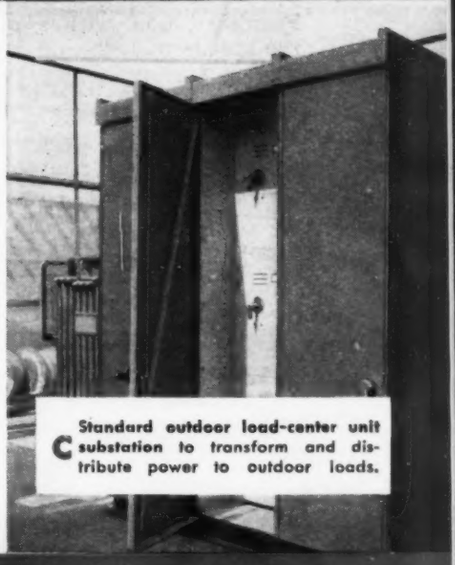
On this page are views of a few of these standard equipments—installed. They are typical of G-E load-center equipments that are being installed quickly and easily in plants everywhere. Note the metal-enclosed construction that safeguards workmen and production.

SAVED 145 TONS OF COPPER WITH LOAD-CENTER POWER DISTRIBUTION

ENGINEERS for this new war plant saved 145 tons of cable copper by taking high-voltage power right to the load centers, as shown at the left. In addition, they got a power distribution system that was so safe and efficient that, when need for additional capacity suddenly arose, they ordered another, a *duplicate* system—and saved another 145 tons of copper.

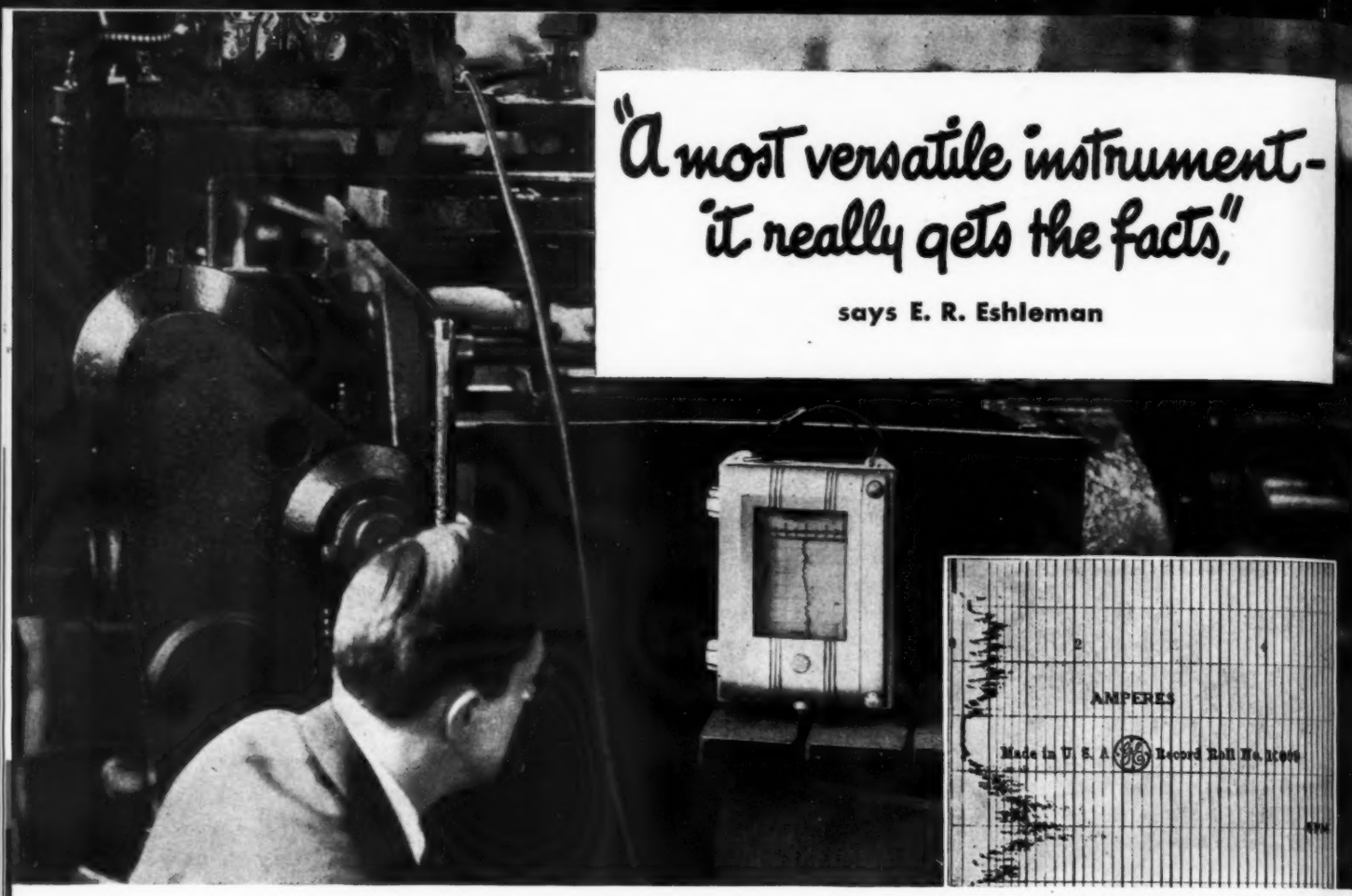
What's more, it took less copper to *build* these standard metal-clad units. The switchgear equipments shown at the top of this page took but 47 pounds of copper each. An open-type, piece-meal assembly would have taken more than four times as much.

If you need electric power for a new, enlarged, or converted war plant, we know you'll be pleased to learn how much copper and other critical materials you can save by using these standard load-center equipments. You'll find, too, that you can get them on the job quickly, and obtain a new high degree of safety and operating dependability. The nearest G-E office is ready to help you. *General Electric, Schenectady, New York.*



C Standard outdoor load-center unit substation to transform and distribute power to outdoor loads.

GENERAL ELECTRIC



"A most versatile instrument—it really gets the facts,"

says E. R. Eshleman

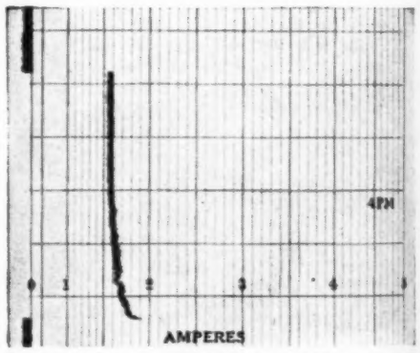
Widely fluctuating load of a group of motors totaling 215 hp. You can easily pick out the current at any instant, and determine, at a glance, the duration of these currents.

G-E Recorders Help Him *GET THE JUMP* on Trouble

"WE have a complete line of switchboard and portable indicating instruments. But these were not adequate. We needed a recorder, and it had to be versatile, inexpensive, and easy to use. So, we selected a G-E inkless recording ammeter (and a split-core current transformer). It's the answer to our needs."

That's how Mr. Eshleman, Electric Motors Co., Lancaster, Pa., feels about this inkless recorder (Type CF-1).

Here's how he has been using it. The charts on the right show the records he has obtained of three important motor tests. When such records are available, it is easy to analyze plant conditions and make corrections before trouble occurs.

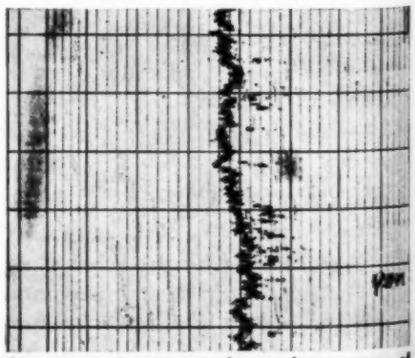


A record of a constant load on a ¼-hp motor. It indicates the definite running cycle, the current immediately after the starting period, and the load variation from the beginning to the end of the run.

New Low Chart Speed Now Available

Furnished now with a one-inch-per-day chart speed—in addition to the speeds of 1, 2, and 3 inches per hour formerly available. This low speed puts a month's operation on a 30-inch chart. That greatly simplifies the work of analyzing surveys.

You can obtain both ammeters and voltmeters (in a wide range of ratings, a-c and d-c) with any of these chart speeds.



This shows the current drawn by a group of textile-mill motors, representing a comparatively constant load with frequent starting periods.

Start Making Full Use of Recorders—
Pick Yours from this Bulletin

General Electric, Sec. E602-37
Schenectady, N. Y.

Please send me your a-c and d-c recorder bulletin, GEA-3187.

NAME .....
COMPANY .....
ADDRESS .....
CITY ..... STATE .....

602-37-6200

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

A *DOUBLE* SERVICE TO UNCLE SAM!

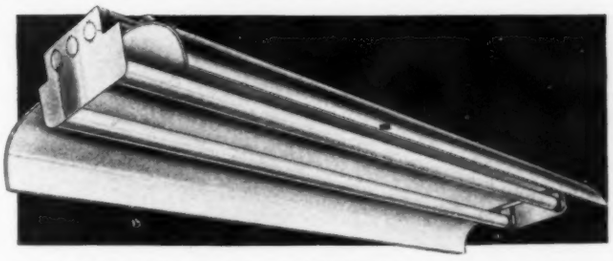
Guth MAZE-LITE

Trade Mark Registered U. S. Patent Office

NON-METALLIC REFLECTORS

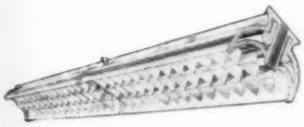
DELIVER MORE LIGHT FOR WAR PRODUCTION— SAVE METAL FOR WAR INDUSTRIES!

THE new GUTH Maze-Lite is designed for 2-40, 3-40, or 2-100 Watt Fluorescent Lamps. Its Reflector is formed of sturdy Pressed-Wood instead of steel. It readily accepts our durable "300° White" flexible-base finish which, with the large "reflector-mouth" design, produces greater light output than does Porcelain Enameled steel reflectors. More light means better seeing to speed urgent wartime production. And the saving of metal releases hundreds of tons for tanks, ships, guns, and planes.

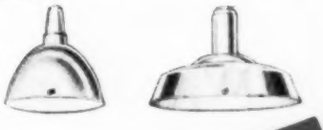


GUTH Fluorescent for Every Industrial Seeing Need!

FUTURLITER—For 25 to 100 Foot Candles, Eggcrate Shielded, Semi-Direct Type Lighting. Continuous and Unit Mounting.



HIGH BAYS AND LOW BAYS for Filament and Mercury Lamps. Porcelain Enameled Reflector Units. Lamp shielding. Heavy duty sockets.



FEATURES OF GUTH MAZE-LITES

1. Durable "300° White" synthetic Baked-Enamel Pressed-Wood Reflector provides comfortable lamp shielding.
2. Reflector edges are sanded clean, then saturated with separate brushed-on enamel coating to guard against moisture.
3. "Side-of-Channel" Starters for easy trouble-shooting. All starters in one group at one end of channel.
4. "Bump-Proof Socket Plates" protect lampholders from abuse and insure their upright positioning in service.
5. Knockouts on 28" centers for direct-attachment of No. 8 Jack-Chain to channel — no extra parts needed.
6. Knockouts on 25" and 38" centers for attachment of ½" Conduit with locknuts.
7. Three knockouts in each End for locking channels together for End-to-End Mounting.

FORTIETH YEAR OF Guth LIGHTING LEADERSHIP

THE EDWIN F. GUTH CO. • 2615 Washington Ave. • St. Louis, Mo.

POLARIZED PLUGS and RECEPTACLES

ARROW

Products to help energize War-production plants

Give more power to MAN-power through more *Outlets* for portable tools. Add to flexibility of plant-equipment with additional power connections for light machines . . . Here's a way for the Electrical Contractor to extend production facilities, — to "energize" manufacturing operations *or* plant-conversion jobs.

ARROW provides many popular types of Polarized Receptacles and Plugs, built for rough handling in war-driven manufacturing. Two, three and four-wire Receptacles, Plugs and Connectors in 10, 20, 30 and 50 Ampere capacity. Above-shown are a few representatives of our *complete line* for Industry's current needs.

SOLD THROUGH YOUR ELECTRICAL WHOLESALER

ARROW ELECTRIC DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

LISTED BY UNDERWRITERS' LABORATORIES, INC.

a motor for use in ...

MAGNESIUM DUST

Also ALUMINUM and other combustible metal dusts

HERE'S a motor specifically approved for service in the presence of magnesium dust (the metal of which incendiaries are made), as well as in aluminum powder and other combustible metal dusts. It fills a critical need of metal-working and ordnance plants, wherever combustible metals are being handled in powder form, and where machining, grinding, or polishing operations are being performed. It's another FIRST among G-E motors for hazardous locations.

Tests of this new totally enclosed motor at Underwriters' Laboratories, Inc., have demonstrated its ability to meet hazards included in Class II, Group E, of the National Electrical Code. For full information, write Motor Division, General Electric, Schenectady, N. Y.

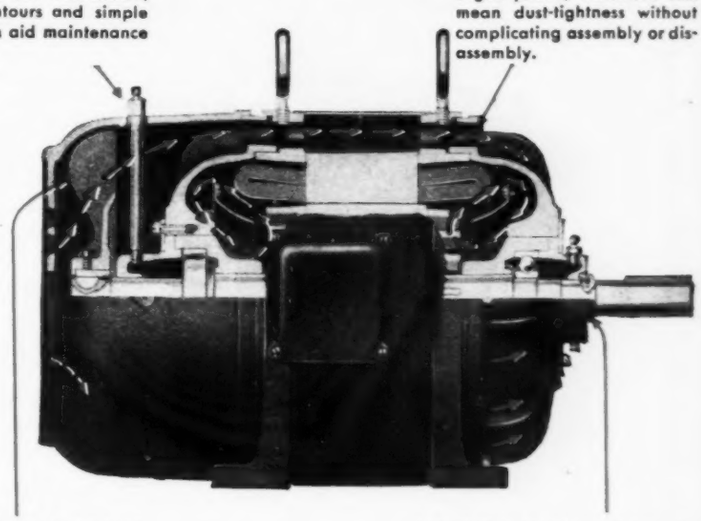
METAL DUST . . . ACETONE . . . TOLUOL . . . GASOLINE . . . COAL DUST . . . GRAIN DUST . . . Name your hazard—this family can meet it.

No single enclosed or explosion-proof motor is recommended for all types of hazardous service. General Electric has pioneered in producing a family of motors to meet the dangers of specific gases, vapors, liquids, and dusts. Our engineering staff can help you pick the right motor, and advise on the use of overload relays and other installation factors for full-scale protection.

Typical Class II, Group E, motor now available in sizes up to 125 hp

Pressure-relief lubrication, smooth contours and simple construction aid maintenance

Tight joints, accurate fits mean dust-tightness without complicating assembly or disassembly.



Effective cooling is obtained even under a blanket of dust

Labyrinth seal and complete cast-iron bearing enclosure exclude dust for continuous operation

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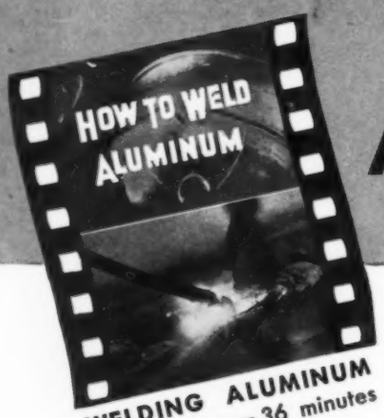
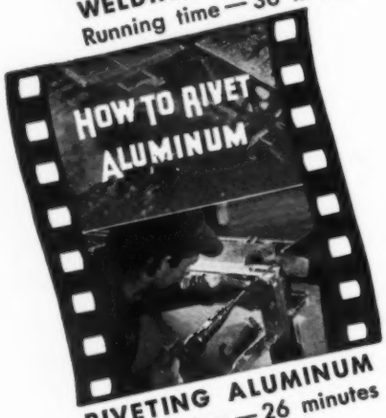


WELDING ALUMINUM
Running time—36 minutes



RIVETING ALUMINUM
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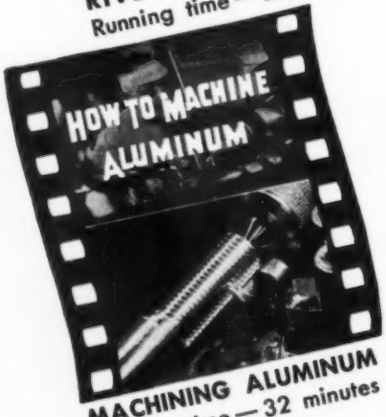

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A PRACTICAL PAPER for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction and maintenance.

There is no unguarded moment in Anaconda's "control" research; the war program and our industry can thus count on the uniform dependability in every Anaconda wire and cable.

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They have recognized Anaconda research as a source for many product improvements and for many completely new developments . . . such as Type CB* construction that outlasts ordinary shielded paper-lead cable three to one. This research is a boon to our war effort . . . it will be equally valuable to industry with the return of peace. *CB—Trade-mark Reg. U. S. Pat. Off. 422643

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We don't recommend the National Electrical Code for reading in bed. In open competition with Ellery Queen or Major de Seversky it is a little on the dry side. But behind the cold, compact little paragraphs there is more glamour than a shelf full of novels. The progress of a great industry and the history of its tragedies have guided the phrasers of the Code, speaking through that unique democratic body we call the Electrical Committee.

The Code has been lauded and cussed through the years with equal enthusiasm. It is too liberal. It is too restrictive. It is dominated by this or that faction in the industry or it does not adequately represent this or that interest. But the Code goes on building, renovating and repairing its sturdy wall of protection against the hazards of electricity.

The Code makers, the men who act on article committees, and those who make up the Electrical Committee as representatives of the various interested groups get plenty of headaches and little glory. They are, however, an impressive aggregation of expert knowledge. They are inclined toward conservatism. And that is a vital quality where men must deal with problems affecting the safety of life and property.

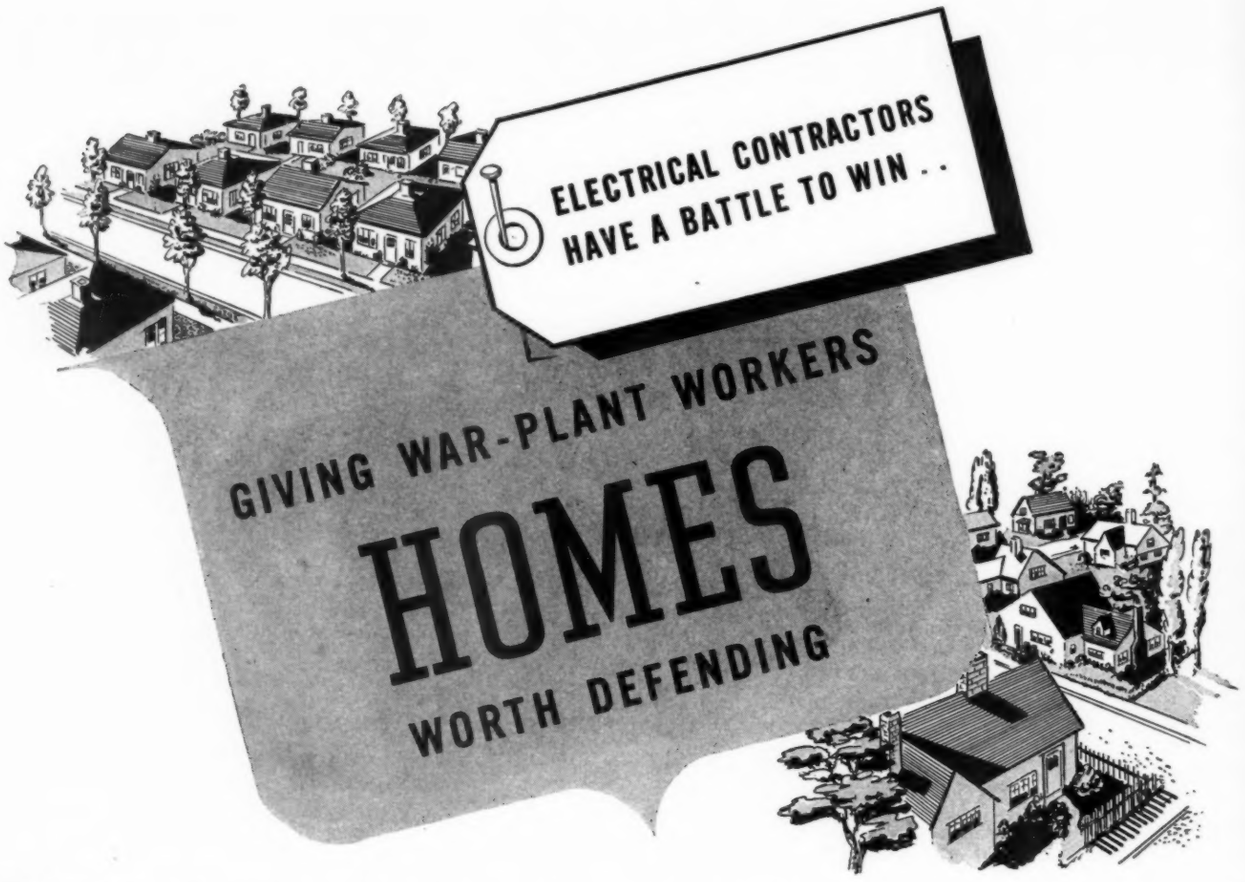
Then, too, the ordinary machinery of Code revision is ponderous. After all the Code is a minimum standard. And there is normally no great urgency in a forward moving industry for revising standards downward.

The war now thrusts a tremendous responsibility upon the Electrical Committee. Critical material shortages, emergency substitutes, improvisation of equipment, wholesale industrial rewiring are some of the new and sudden problems to which the Code must be adapted and to which it is being adapted today with amazing speed.

With the characteristic directness of practical men the Electrical Committee set up an emergency committee and a mail ballot procedure. Rules were changed to permit the adoption of interim amendments on a "duration" basis. The standards of safety created through the years are retained. Yet urgent and essential war revisions are quickly adopted.

The amendments already approved are vitally important to all of us who are concerned with electrical construction and maintenance. They should be followed carefully. They are opening the way to conservation of many critical materials sorely needed for war.

In spite of the urgency of the tentative amendments coming before it, the Committee has acted with caution and with a grave sense of the responsibility it has shouldered. It is doing a difficult job. It is performing a distinguished service for our industry and our country.



BIGGEST challenge local electrical contractors have ever faced is the current housing program for war workers. Handicapped by shortages of manpower, materials and equipment . . . electrical contractors are still doing their best to meet scheduled construction plans. They are still contributing all they can to the American standard of *electrical* living.

To obtain essential electrical wiring supplies for these housing projects under present conditions, contractors need the best local aid they can get. Here is where GRAYBAR service can be especially useful . . . in helping contractors find out what materials are immediately available on their priority rating . . . in helping them choose acceptable substitutes when specified materials are lacking. Most important of all, GRAYBAR service assures fast local delivery of available supplies and so helps prevent work slow-downs.

No matter what war job you tackle . . . homes for war workers . . . army camps . . . industrial conversions—you can get the help you need, in a hurry, from your nearest GRAYBAR warehouse. More than 200 manufacturers of equipment frequently specified for all types of war jobs depend on GRAYBAR to speed their products to the point of use. GRAYBAR specialists are also ready to help you meet unusual problems on any electrical or lighting need.

These Graybar-distributed products are widely used in home building.

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Service entrance cable, multibreakers, fuses, wiring devices, building wire. Rigid and thinwall conduit and conduit fittings.

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The Aviation Industry is doing its job...

A Year's Production A Week — Every Week

A MERE hundred planes a month in 1938; 200 in 1939; 450 in 1940; 1,600 in 1941, and today, as this is written, plane production goes on at a rate of 5,000 a month. A previous year's production now in one single week — every week.

So begins the story of the greatest industrial expansion in history; an industrial miracle that far surpasses anything our enemies ever have done or can do. Not only did we out-produce the Axis but the acceleration in our production during the past 12 months exceeded the greatest increase in German output during their forced-draft war preparation of 1939, when their production rose from 1,100 to 1,600 planes per month.

The toughest part of our job was accomplished in 20 months. We boosted deliveries from 100 or so to 1,000 planes a week, passing the combined Axis powers. Today, Germany's curve is flattening; ours is climbing steeply. Lt. Gen. Henry H. Arnold, Chief of the Army Air Forces, assures us that Army contractors will produce not less than 148,000 planes in the remainder of 1942 and in 1943. During that same period Navy contractors will turn out at least 37,000 additional planes.

Manpower in the airframe, engine and propeller industries was increased from 125,000 to 450,000 workers during the past 20 months, with the prospect that the industry will be employing more than 1,000,000 men and women in 1943. Many manufacturers are solving their personnel problems by recruiting women workers. More than 40,000 of them — teachers, stenographers, waitresses, housewives and school girls — today are welders, assemblers, machine operators and inspectors on aircraft production lines. Productive floor space in the airframe, engine and propeller industries expanded from 18,000,000 sq. ft. to nearly 55,000,000 sq. ft. during the last 20 months. Further expansion to more than 60,000,000 sq. ft. may be expected this year and an ultimate figure of more than 100,000,000 is a distinct possibility.

To grasp the full magnitude of this task we must remember that a single medium bomber has 30,000 parts, which are built into 650 minor sub-assemblies to make 32 major sub-assemblies. The entire process involves 30,000 man hours of labor. Each of the two engines in this plane requires 50,000 specialized inspections. Every one of the 50 instruments entails many hours of precision workmanship. Yet today there is one factory turning out 4 bombers every day. Another produces fighters at the rate of nearly 20 a day.

To the amazement of the entire world these manufacturing miracles were accomplished without sacrificing the high standard of American aeronautical equipment. There has been some loose talk about the quality of our combat airplanes as compared with those of our allies and our enemies. Indisputable evidence of the superior stamina of our aircraft under fire is written between the lines of almost every war communique. Every battle record tells a story of heavy losses inflicted at small cost upon numerically superior enemy forces. The consistency of this performance on all the far-flung battlefronts constitutes the most eloquent testimony of the high calibre of our designs, our manufacturing methods and the skill and daring of our pilots.

And let us remember that our decisive victory in the battle of production was not won without headaches and heartaches on the part of management, labor and government.

When the President sounded the call for 50,000 planes in the spring of 1940, the program called for only 5,500 military aircraft. Government and industry reeled from the shock — both determined, however, that it *could and would be done.*

The Army, the Navy and the old Defense Advisory Commission set to work to draft a program. This has been revised many times — upward! Congress then proceeded, more slowly, to modify the laws that would have obstructed the realization of the objective. Then the aviation industry, without contracts, in the face of discriminatory profit-limitative legislation, and with nothing but oral assurances of governmental intentions, went ahead with its Herculean expansion plans. New factories were completed long before facilities-contracts and their funds were forthcoming.

The rugged individualists who had founded and built the aviation industry cast aside their rivalries and embarked upon a period of unselfish cooperation. Priceless engineering experience was exchanged. Material was relinquished for transfer to plants where it was needed more urgently. Successful personnel training methods and experience in the use of women workers were pooled for the benefit of all concerned. During one re-

cent month, the cooperation among eight southern California plants averted more than 1,860 potential bottlenecks in production.

As the lessons of the war dictated the need for greater numbers of particular airplane types, many manufacturers accepted orders for planes designed and developed at rival factories. Striking examples are the long range bombers being turned out by plants where only trainers, fighters or dive bombers formerly were made.

Mindful of the risk involved in educating rivals, thereby creating future potential competition, subcontractors nevertheless were sought and trained by pioneer manufacturers. Makers of toys and wheelbarrows, automatic stokers and linoleum were among those who rallied to the call. Within a year subcontracting rose from 13 to 36 per cent of the total program. It still is rising.

When the automotive industry came into the picture, aviation manufacturers gave generously of their time and knowledge to start the newcomers. Liberal licensing arrangements enabled them to reap the full benefits of technical developments. Automotive engineers swarmed through the aviation plants in search of the exacting "know-how" of the aeronautical industry.

Each type of aircraft that reaches the production stage is the result of long periods of research, design and development. The unseen workers toiling in the wind tunnels and the laboratories of government and industry are the unsung heroes who tirelessly are striving to surpass all previous efforts. Their brilliant accomplishments are eloquent testimony of the superiority of men and women who are blessed with freedom of action and thought. Today more than 20 experimental combat airplanes are under development and will replace older types as soon as they fulfill the exacting requirements of our armed forces. Among these are aircraft that promise to outfight and to out-perform any and all of the much vaunted warplanes of the Axis military machine. And this without loss of production.

Every man, woman and child of all the United Nations may fervently be thankful that those who chart our course in aircraft production have not frozen design to such a degree as to make impossible the immediate adoption of improvements as they come out of these laboratories.

What does this brilliant record mean in terms of final victory?

Every newspaper reader has learned this basic war lesson . . . air supremacy is the essential ingredient of military success. As the balance of air power shifts, so do the fortunes of war.

In those dark days when our output was 500 planes a month, Germany's was 2,000 and the German air force was twice that of our Allies. When we reached 2,000 a month last fall, Germany had advanced to a monthly rate of 2,500. Today, as this is written, we have caught up with the enemy's backlog. The air forces of both sides are about equal numerically and United Nations' production exceeds that of the Axis by 27 per cent. Next summer (1943) both the air force and the output of the United Nations will be double those of all the Axis powers.

That is the pattern of ultimate victory!

The pattern of the peace to follow also is gaining in definition. The airplane has shriveled the world to one-fifth its former size. Its use as an instrument of destruction is but a momentary distortion of the pattern of human progress. Its potential power, as a stern preserver of peace, is beyond imagination. Today's air routes of our Army Air Force Ferrying Command are the international trade routes of tomorrow. Giant airliners, by reducing time and space, will speed fraternity among the nations and disunity will give way to better understanding and goodwill.

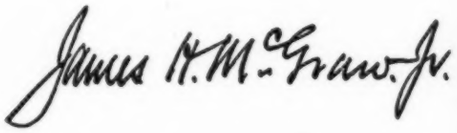
Flying freight trains, with aerial locomotives towing glider boxcars, will serve large cities, decentralizing population and giving to inland cities many of the commercial advantages of seaports. Air mail and passenger pick-up lines will fill the gaps between these transcontinental trunk lines and tie in the smallest hamlets. Universal fly-it-yourself services will provide airplane facilities for those who do not own low cost private aircraft. Roadable rotary wing aircraft and family planes of the fixed wing type may even run household errands.

The coming generation of business men who today is piloting our war planes will find aircraft as essential to business as it now finds them essential to victory.

Commenting on our war production record, Donald Nelson has said, "We are today in the position of men who realize that they are actually doing the impossible".

The mass production miracle that the aviation industry – management and workers alike – has performed through the all-out effort of free enterprise can and will serve civilization in peace as it has in war.

With this boundless new medium of transportation and its concurrent technological developments we shall rebuild our way of life to a rich, new fullness upon the ruins of a war-torn world.



President, McGraw-Hill Publishing Company, Inc.

This is the third of a series of editorials appearing monthly in all McGraw-Hill publications reaching more than one and one-half million readers.

LAYERS OF CABLES *are racked in the cable tunnel under the master substation. Large cables are the 4167-volt generator feeders; smaller ones on top are the 28-conductor control cables. Conduits on ceiling contain feeders and control cables for auxiliary units.*

POWER RECOVERY

Generators coupled to aircraft engines recover much of the power expended during engine test periods. Elaborate electrical controls maintain constant generator speeds and operate numerous safety devices on the test equipment.

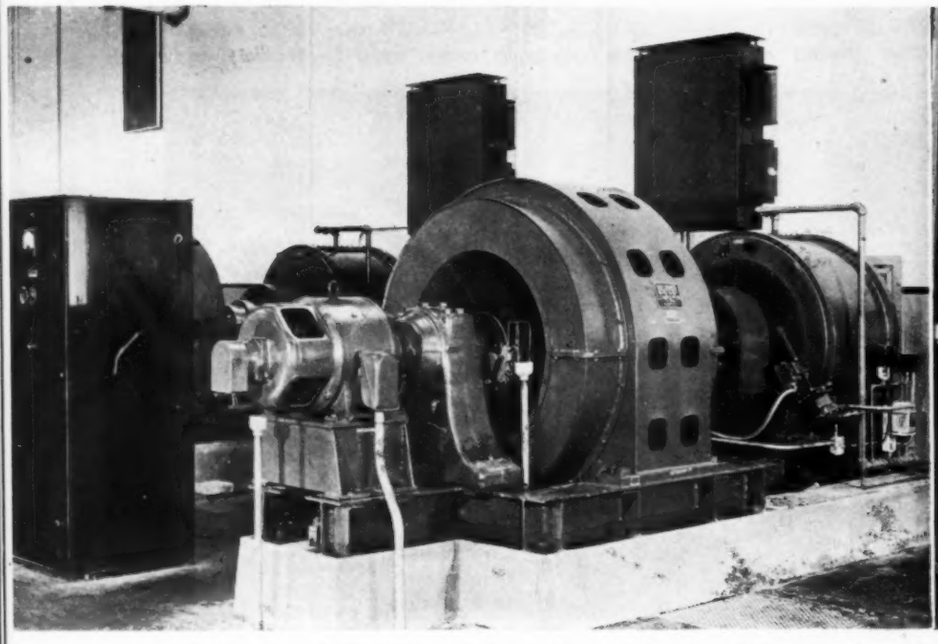
By C. A. Chayne
Chief Engineer
Buick Motor Division,
General Motors Corporation

AIRCRAFT engines, unlike automobile engines, cannot be broken-in by flying a plane slowly at so many miles per hour for a certain period of time. Maximum power of the engine is needed to get the ship off the ground. Hence, when delivered to the plane manufacturer, the engine must be thoroughly run-in and ready to work.

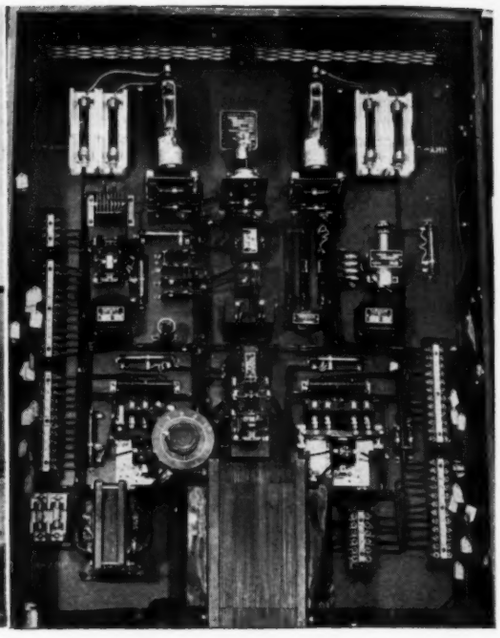
This factory testing of aircraft engines can be done by using one of three types of test equipment: the propeller house, using a flight propeller or wooden club to apply the load; the absorption dynamometer of the direct current cradle, eddy current, or water-brake type; and the power recovery system known as "feed-back." The first two methods are open to the same fundamental criticism—the power is absorbed either by doing useless work or by converting it into another form of energy which is then wasted.

We have adopted the third system at our aviation engine plant, because it is the only system that offers any sort of return for the money expended on gasoline for testing. In this method our engines are placed in "test cells"—large square rooms with heavy concrete walls and double refrigerator-type access doors. Large double glass windows on two sides of the cells permit test engineers in the control rooms to watch the engine on test. The engine and test stand assembly are mounted to the test cell bed plate and connections with snap-on couplings are made to the test stand instrument, oil and fuel lines. The engine is connected to the coupling of the power recovery equipment shaft which extends through the test cell wall by means of a noise seal. This feed-back equipment consists of a magnetic coupling of the eddy current type which maintains constant speed on its output shaft while the airplane engine operates at whatever speed is desired; an air operated brake on the output shaft of the coupling; and an alternator with its exciter mounted to the same shaft. The alternator is of sufficient capacity to absorb all the power the engine is capable of developing during test.

The alternators are of two different



POWER RECOVERY EQUIPMENT *outside an engine test cell consists of (from right to left) magnetic coupling; air brake; generator; and exciter. Panels on wall contain the electronic constant speed control for the magnetic coupling; cubicles at left are for generators.*



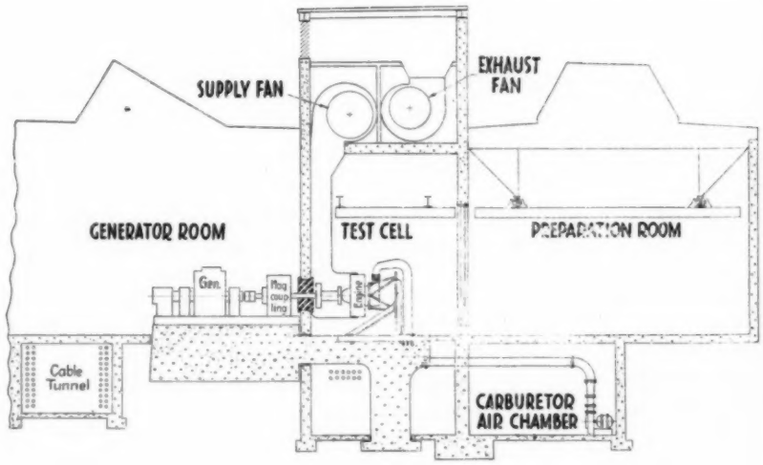
ELECTRONIC CONTROL CABINET *outside test cells, maintains constant speed on the output shaft of the magnetic coupling regardless of the speed of the engine on test.*

types; a 1,000 kva. unity power factor unit; and a 1,200 kva. 0.80 power factor unit which, when not used for testing, can be idled on the power lines as a synchronous condenser to keep the overall power factor at the highest figure.

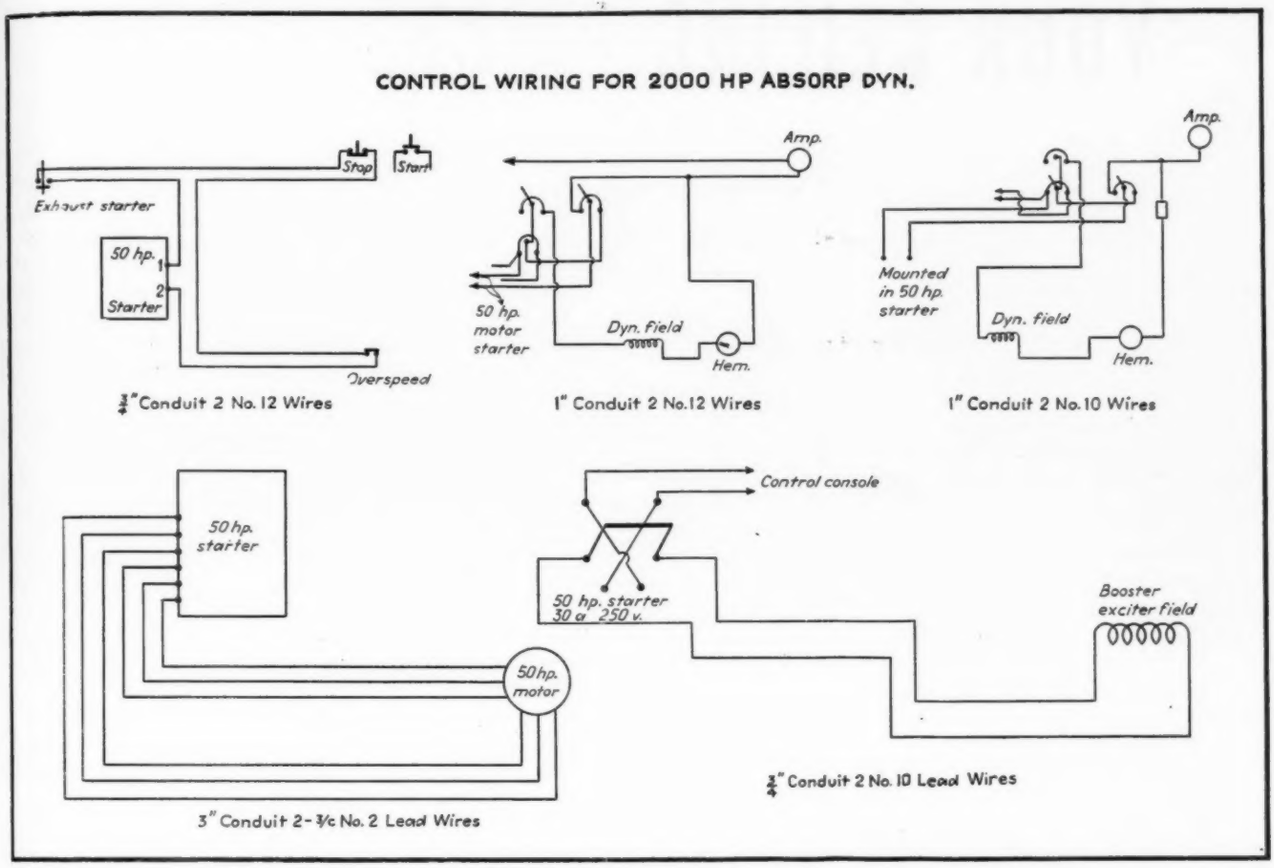
How Feed-Back Works

The alternators of this system serve a dual purpose. They are used as motors to start the aircraft engine, then go back on the line as generators driven by the engine on test. To understand this more clearly, let's follow through on an actual test operation. When the engine is connected and ready for test, the alternator is brought up to speed before the magnetic coupling is energized. When the alternator is on the line, the coupling is energized just enough to crank the engine over slowly. As soon as the engine fires, the coupling is de-energized and the alternator cut off the line. Here the air brake may be used to stop the alternator and lock it stationary. Under these conditions the coupling may be again energized and function as an eddy current, absorption type, dynamometer, permitting the application of load to the engine at speeds below the synchronous speed of the alternator. The power thus developed is transformed into heat which is dissipated in the cooling water of the coupling.

When the test schedule calls for engine operation at speeds above synchronous speed, the brake is released, the alternator brought back on the line and operated as a generator pumping power back into the lines. Under these conditions, constant-speed at the generator is maintained by the coupling speed control system. Power recovered by this method is used by the plant, reducing the amount that need be purchased from the utility. If, as sometimes happens, the amount of power pumped back into the lines exceeds the plant requirements, the surplus is fed back into the utility lines.



TYPICAL TEST CELL *showing the connection of power recovery equipment to engine on test; supply and exhaust fans; carburetor air chamber; generator room and cable tunnel leading to the master switch house.*



SIMPLIFIED DIAGRAMS *such as these break down complicated control wiring into its component parts; giving conduit and wire sizes; and "to and from" information on that particular portion of the circuit outlined. Made up in pamphlet form, such sheets give the entire control story in easy-to-understand doses, speed the job and eliminate errors.*

Although the above described system of power feed-back seems quite simple in operation, it requires an elaborate network of controls and safety devices to permit the engines to be tested as desired and at the same time properly protect the engine on test as well as the operating personnel.

First, let's consider the controls on the magnetic couplings. These water-cooled units are of a standard type and have sufficient capacity to transmit the maximum torque of the engine. One of the most satisfactory features of this type of slip coupling is the method provided for controlling the speed of the engine. The field of the coupling is equipped with electronic tube control. There is an alnico generator on the input shaft of the unit. This is in the grid circuit of the electronic tubes and provides a constant speed control on the output shaft of the unit while the engine speed varies according to test schedule.

Not only is electrical control adapted to the speed control of the generators, but an elaborate system of interconnected relays provide safety features to the entire operation of the test cell. The automatic safety devices on the coupling include: an overspeed safety device which shuts off the ignition system of the engine should its speed rise above a determined figure and an interlocking control which prevents energizing the magnetic coupling until the cooling water is on. If the water supply should fail during a test, the coupling excitation goes off and the overspeed safety cuts off the ignition. Also, there is a safety device which prevents the application of the air brake at a wrong time during a test. If such a thing should happen, the coupling is de-energized, and the alternator is tripped off the line and the overspeed device shuts off the engine.

The alternators are also equipped with overspeed safeties—with relays in the field circuit which disconnect the alternators if the field excitation is lost —and also with relays which disconnect the alternators if the frequency exceeds or drops below predetermined limits.

Other safety devices incorporated in the test cell design shut off the ignition or flash a warning light or blow a horn if, for instance, the automatic fire extinguisher system in the test cell goes into action; or if the exhauster fan, which scavenges the cooling air and the exhaust gases out of the cells, shuts down; or if the oil pressure on the engine drops below a certain value essential to proper lubrication. In short, safety is practically automatic.

All the alternators, absorption dynamometers for experimental work, electronic tube controls, and generator control cubicles are installed outside the test cells, to permit maintenance and easy access to the equipment.

Approximately fifty percent of the test cell control room instruments, are electrically controlled.

Wiring Methods

Feeder and control cables from the alternators to the master switch house are run in a cable tunnel under the floor of the generator room. Each generator

[Continued on page 128]

YOUR CEILING PRICES

The lowdown on price peaks for electrical contractors with interpretation of the new OPA rules.

By Arthur Roberts

SERVICE sales were frozen as of July 1 and many electrical contractors are in a quandary as to future operating procedure. The OPA regulations give only the rules for pricing service but leave it to the contractor to cost sales under ceilings as best he can in order to come through with a profit. OPA regulations prevent you from charging more for service after July 1 than your peak prices for the same or similar services in March 1942. This may put the contractor in a tough spot if he was costing March service sales unprofitably, for his service and repair sales will amount to a substantial volume during the war and should profit on that volume.

A thorough understanding of costing service and repair sales and its application is most important, so we offer this counsel to help you get over the top under price ceilings.

There are three general methods of costing service, to wit:

1—*Cost plus.* The contractor charges for time and materials plus a percentage for overhead expense and net profit. Under price ceilings, he must adhere to the peak March figures on labor materials and the plus-percentage used.

TYPICAL CEILING PRICE METHODS

Italics indicate points at which peaks are frozen.

RETAIL SALES: — Materials and labor at March retail *prices*

Example: — Repairing switch

1 single pole switch	*$.46*
1 hour, mechanic	*2.70*

CONTRACT WITH ESTIMATE: — *Method* of pricing and mark up must not exceed *highest* used in March.

Example: — Wiring for lights and motors

Materials at cost	$380.00
Labor at cost	240.00
Direct job expense	60.00
Total	690.00
Overhead at *40 per cent*	276.00
Profit at *10 per cent*	27.60
Total ceiling price	$993.60

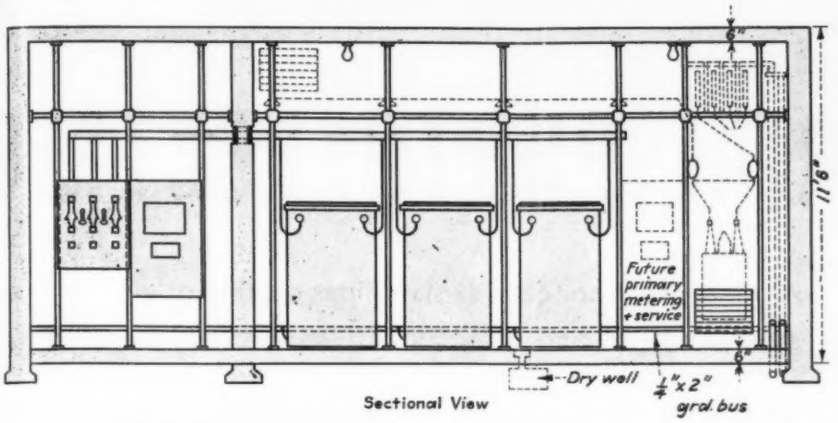
Note: Material prices are frozen at the manufacturing and wholesaling level.

2—*Contract price based on estimates:* If you estimated $50 for a certain type of repair service in March, that does not mean that all the same or similar repairs after July 1 must carry this $50 peak. The same or similar services may vary in labor time depending on conditions met. Obviously, if a contractor had to freeze his selling price to a March service job that took only 3 hours time, he would be in a bad way, because the same or similar jobs after July 1 might require more labor hours and he would have to pay the difference out of pocket. You are permitted to break down contract prices into labor, materials and overhead. You may charge the peak price *per hour* for labor used in March when figuring the same or similar service after July 1, thus if a service job thereafter takes longer to do than in March, you will not lose on the labor cost. Material prices must remain the same and you can't pad your overhead percentage. Your suppliers cannot increase their prices over March peaks so your margin on materials should remain stationary for the duration. Unless wages, which have no ceilings yet, increase, you are safe here too and there are rumors that wages will be stabilized. If you keep your overhead-to-sales ratio static, you won't lose on expense. If you can cut overhead, you may increase profit on service after July 1. If you costed sales accurately in March and made a profit, you should fare equally well under price regulations.

3—*Contract price without estimate.* Contractors offer such flat rates for servicing oil burners, coal stokers, electric well systems and other appliances, either by the season, year or call. Flat rates in the past have been built up by averaging the costs of 15 or more similar jobs, then using these costs as standards to arrive at the fixed contract prices. This saves estimating but losses have frequently been experienced because contractors did not change their rates when materials, labor or overhead increased. To assure success with flat rates, it is necessary to revise them continually in line with changes in over-all costs or competition. Sometimes contractors have had to decrease flat rates even though materials or labor increased because competitors undersold them on similar or the same services. As a result, sales were low, making the overhead percentage to sales abnormally high. A cut in the flat rate then stimulated volume, reduced overhead and increased profit, despite a bigger outlay for labor or materials. From our observation, we believe that this method of pricing service sales will cause trouble for some contractors after July 1. Those who used the same flat rates while prices were rising, who sold such service in March, are in a tight spot and must take corrective measures—or else. Many cases have been analyzed by us where contractors charging lower flat rates were earning more profit than those charging more. Why? Their over-all costs were more in line with prices on service.

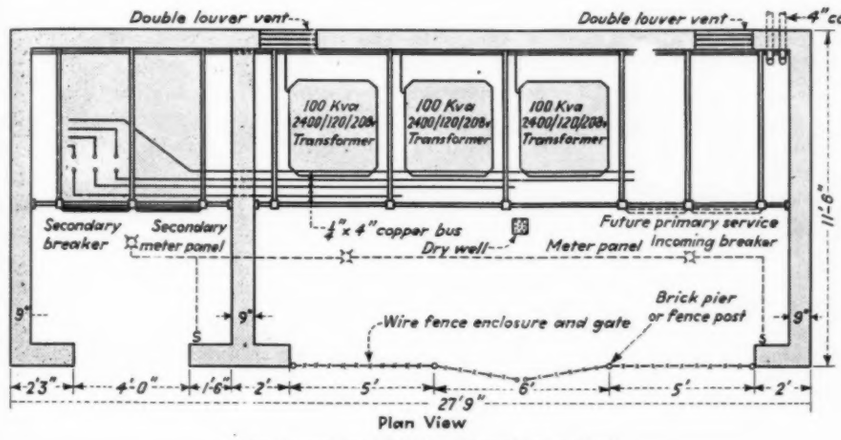
Because labor and materials can carry March selling peaks, and inasmuch as labor is not likely to go higher after July 1, and suppliers cannot increase their prices on materials over the March peaks, these elements of service cost are reasonably stable. If your overhead percentage used on estimates that resulted in sales, those sales with peak selling prices on service or repairs in March, was lower than the actual overhead cost to you in dollars, you will have trouble. If your flat rates on service were figured unprofitably in the past, particularly during March, you will be in a bad way after July 1. This applies regardless of the method used in costing March peak sales. Some contractors are using March margins as a guide to movement under price regulations but your margin will tend to remain static because the costs of labor and materials should not change. You may have listed labor, materials and direct job expense accurately in March but cheated yourself on overhead rationing, and if such a service sale represented the peak price pattern to which you must cut all the same and similar service sales after July 1, you had better act quickly, brother. To thaw out safely, analyze

[Continued on Page 103]



Sectional View

SECTIONAL VIEW *of the compromise vault showing the secondary switch and meter room at the left; the transformers; and future primary service equipment sketched in at the right end of the enclosure. Large dotted rectangles represent the double louver vents.*



Plan View

Semi-enclosed Outdoor Transformer Vault

SEMI-ENCLOSED VAULT *houses outdoor transformers and secondary switching and metering equipment at this war plant. Substitution of a concrete or brick wall with doors, for the wire fence and gates makes a standard indoor vault. Blank space is for future primary service equipment.*

Convertible Transformer Vault

An open-front, outdoor transformer vault that is designed to permit plant expansion around it. It can be easily converted to an indoor vault with primary service and metering.

By Frank J. Bray *E. J. White Company, Newark, N. J.*

WHEN the E. J. White Company, electrical contractors of Newark, N. J. was called in to do the electrical work in a war plant conversion job, the question of a suitable transformer mat arose.

We were converting an old ice manufacturing plant into a machine shop and parts assembly plant for war production. The only logical place for the transformer mat was outdoors beyond the building, but in direct line with any future plant expansion which would completely envelop it. Should we leave the mat outdoors, or build an indoor vault?

We finally chose the outdoor location and designed a compromise openfront transformer vault. Then, if and when the plant expanded around the transformer location, a third wall would provide a standard indoor vault.

The semi-vault is 27-ft., 9-in. long; 11-ft., 6-in. wide; 11-ft. 6-in. high and is made of 9-in. reenforced concrete with a pre-cast 6-in. concrete slab roof. The floor slab is 6-in. thick. One entire end of the vault forms a 10-ft. by 7-ft. secondary switch room enclosing the secondary breaker and metering panel. The open-front, 10-ft. by 18-ft., 6-in., transformer section has a wire fence enclosure with a 6-ft. double gate as the fourth side. Double louvered vents at the top and bottom of the rear wall provide ventilation for the three 100 kva., 2400/120/208-volt transformer now installed. Ample space is also provided for a future high tension breaker and metering panel in case an increase in plant load warrants primary metering. Two 4-in. primary conduits go underground to the utility pole nearby.

A pipe rack extending the full length of the vault supports the main secondary breaker and meter panel; the primary and secondary transformer buses; and will also support a primary breaker and meter panel that may be installed at some future date. At present the primaries to the transformers are mounted on the underside of the horizontal pipe supports. When a primary breaker is installed, primary buses can be quickly and easily installed on top of these brackets. The secondary buses consist of four ¼-in. by 4-in. copper bars mounted to the underside of the bracket. A ¼-in. by 2-in. copper ground bus for equipment grounding, extends the full length of the rear wall.

When and if the building does expand around the transformer, a 16-ft. long wall with proper doors to enclose the fourth side will be the only construction needed to make a standard indoor vault. Lights are already installed.

This design, which has been approved by the local power company and inspection authorities, provides one solution to the problem of transformer location where possible future plant expansion may envelop the units.

INDUSTRIAL PHOTOELECTRIC

A clear and concise explanation of the operation and application of photoelectric industrial control apparatus.

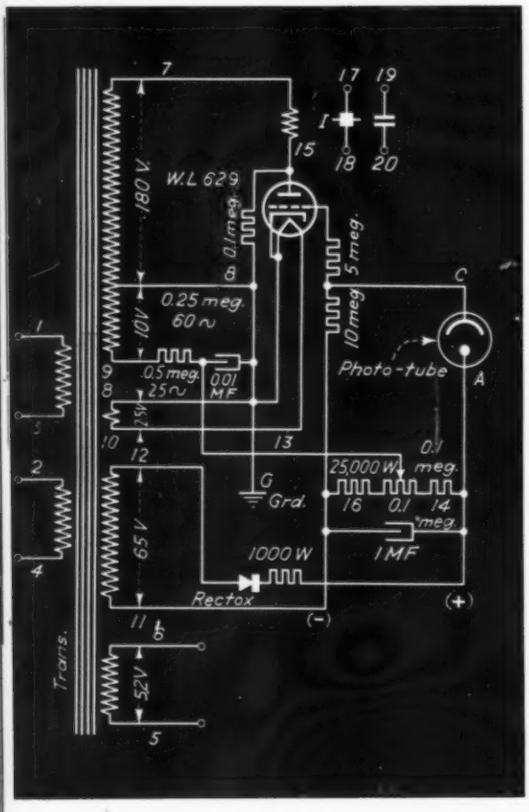


FIGURE 1. *A typical photoelectric circuit. The relay contact terminals at 1 connect into the circuit to be controlled. The relay coil is actuated by the current through the thyratron controlled by the phototube.*

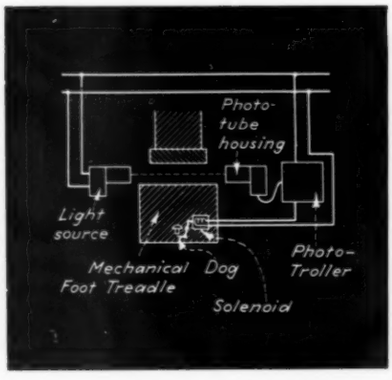


FIGURE 2. *A protective installation on a mechanically controlled press operates a dog on the foot treadle preventing operation unless the line covered by the light beam is unobstructed.*

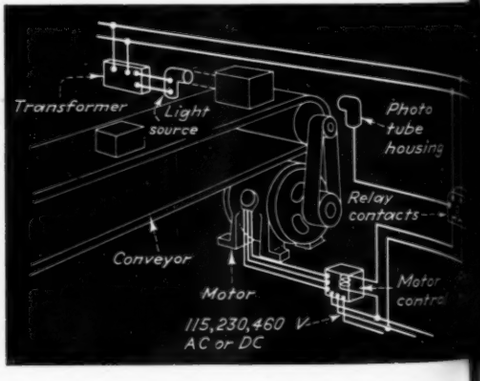


FIGURE 3. *As a limit switch there are innumerable applications. This conveyor application stops the conveyor motor when objects reach the end of the belt.* (*Below right*)

THE lack of more complete understanding of photoelectric control equipment probably comes from the fact that the functions of the various parts of an electronic system are not immediately as obvious as those of mechanical contactors or switches. Operation takes place without mechanical movement. Yet photoelectric equipment will perform many routine tasks which, in turn, will release manpower for other important work in the war effort.

The impression prevails among some industrial engineers that photoelectric equipment is a "delicate gadget" consisting of radio tubes and a maze of wires, resistors and capacitors crowded together in an enclosure of some sort. This is an erroneous picture. While photoelectric equipment is usually rather compactly built and entails the use of numerous small resistors, capacitors, and transformers, it is constructed to meet the same rigid requirements of other industrial control equipment.

Industrial tubes are sturdily built and long lived. The relays used are rugged and long lasting. Maintenance presents no greater problem than the average industrial control equipment and, in many cases, requires even less servicing.

The feeling that special knowledge of electronics is necessary in applying photoelectric control equipment is widespread. This is not quite true. In applying photoelectric control equipment, it is essential to know what the equipment can do and how it can be applied, but it is not necessary to understand all the fundamental theories behind its operation. For example, in buying a radio, the average person is not interested in how the set operates as long as he can listen to his favorite programs. The same feeling should apply to the use of photoelectric equipment.

It should be understood in the beginning that the "electric eye" or phototube functions as a *light-operated switch* and should be applied as such. While the design of the photoelectric equipment may be varied to give different operating characteristics as a switch, it is still basically a simple switch.

A complete photoelectric system consists of a light source, a phototube, and an electronic circuit for amplifying the changes occurring in the phototube due to the change in the amount of illumination falling on it. The amplifier is usually used to energize a small relay. The light source is usually mounted in a housing containing a lens system for focusing the light beam in the required manner. In most designs of photoelectric equipment the amplifier and relay are mounted in the same cabinet. The phototube may either be mounted in the cabinet with the amplifier and relay or may be mounted in a separate phototube housing. A lens system may or may not be used for the phototube depending on the overall sensitivity of the unit.

Though it is not necessary to know all the details of how the equipment operates in order to use it, it may be of interest to briefly run through a typical circuit.

Figure 1 is a schematic diagram of a Westinghouse type RX photo-troller which uses one type WL-735 phototube and one WL-629 thyratron tube. The phototube emits electrons when exposed to light. The thyratron tube is a gas-filled grid-controlled rectifier tube. When its grid has a negative potential exceeding approximately six volts rela-

APPLICATIONS

By W. E. Love
Electronic Control Section
Westinghouse Elec. & Mfg. Co.

tive to the cathode, no current is conducted through the tube. However, if the grid potential is made more positive, the tube "breaks down" and conducts current.

The grid control voltage as shown in figure 1 consists of the a.c. voltage component between leads 8 and 13 obtained by means of the phase shift circuit consisting of the 0.25 megohm resistor between leads 9 and 13 and the 0.01 mfd. capacitor between leads 8 and 13, and the d.c. voltage component existing between leads C and 13. The voltage between 8 and 13 is advanced 135° relative to the voltage 7-8.

When the phototube is illuminated, d.c. current is passed by the phototube, the amount depending upon the intensity of the illumination. When the illumination is high, the d.c. voltage component between C and 13 is less negative, making C less negative in relation to 13. The magnitude of this voltage is such as to cause the tube to conduct current, which in turn, energizes the relay coil. As the illumination is decreased, the d.c. voltage component between C and 13 becomes more negative, thus causing C to be more negative with respect to 13. The thyratron no longer conducts current when this condition exists.

There are an almost unlimited number of possible industrial applications of such a fast-acting, light operated switch. Some of the more common of these are: 1. Safety guards on machinery; 2. Counting; 3. Limit switch; 4. Automatic door control; 5. Guarding restricted areas.

Perhaps at this point it is well to see how the photoelectric equipment is used in these applications.

First, consider, its application as a safety guard on machinery and, for a typical example, consider its application on a punch press.

The operator of either a mechanically or electrically controlled press may be protected by placing the light beam on the press in such a position as to be interrupted when any part of the operator's body is in danger of being harmed. In most applications of this nature, a small solenoid is energized when the light beam is interrupted.

On mechanically controlled presses, this solenoid can be mechanically con-

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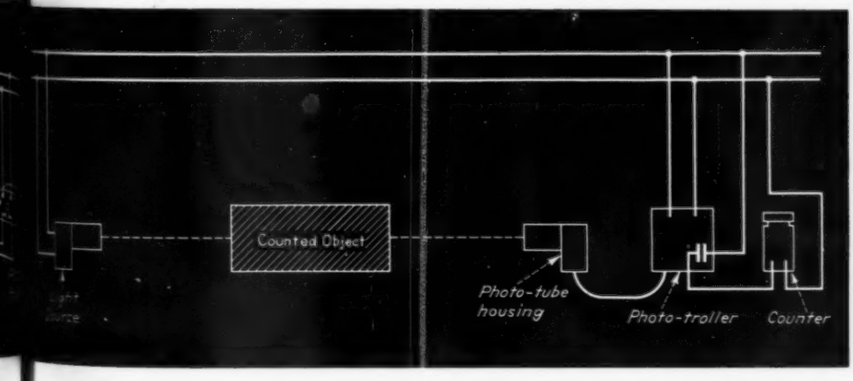
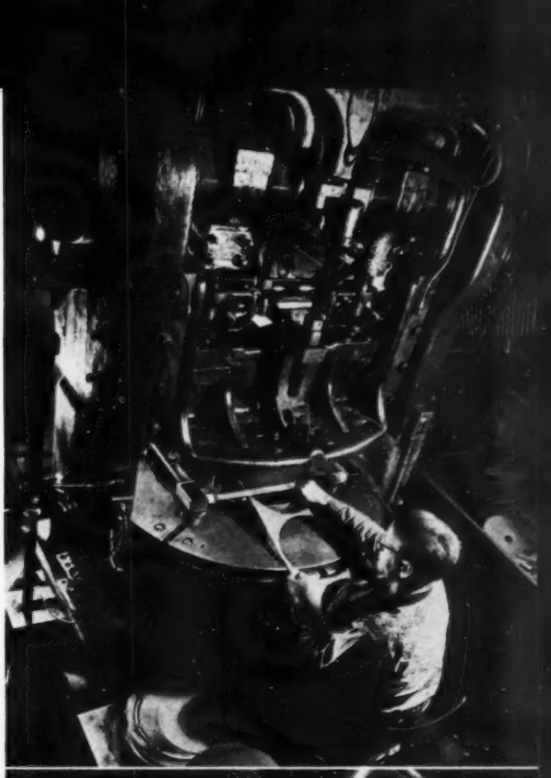
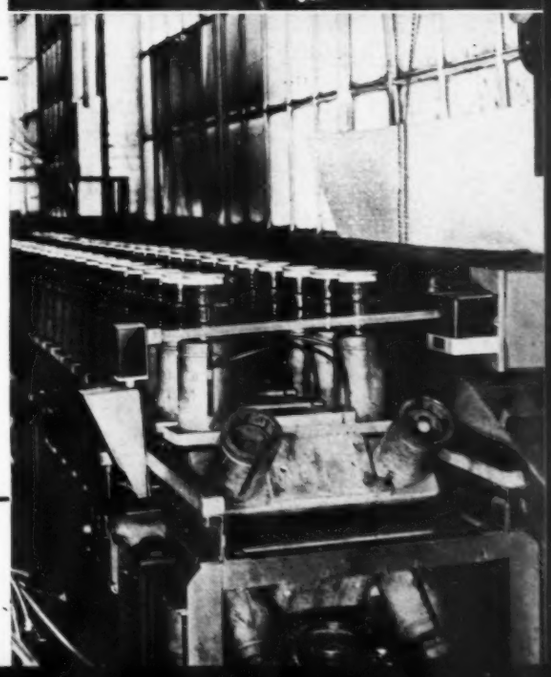
FIGURE 4. *Counting objects on a conveyor at a high rate of speed with extreme accuracy is one of the more common applications of photoelectric equipment.*







PROTECTIVE BEAM *of photoelectric safety guard prevents operation of this press until the operator's hands are out of the way.* (TOP)

GUARDED SHEAR *permits safe operation though two or more men may be handling the metal. Light beam must have a clear path down.* (CENTER)

CONVEYOR LIMIT *beam stops the line when intercepted.* (BOTTOM)

LABORATORY HUM *test being made for ballast hum with use of Sonoscope.*

Surmounting

Eliminating noise and reducing temperature are important considerations in installation of fluorescent ballasts.

FLUORESCENT lighting today is a valuable war tool. Maintenance of 24-hour-a-day production schedules in vast American war plants, depends on its reliability and quality. Expansion of industry and speed-up of precision work has created many new applications, entailing more intricately engineered systems than heretofore necessary. In industry, both high-bay and low-bay installations are used. Individual machine tools are equipped with units, and work benches are individually lighted for detailed inspection work. Engineering offices and drafting rooms are utilizing its daylight qualities. All of this places more emphasis than ever before upon trouble-free operation.

Depending on the type of lighting required, many types of fixtures are necessary to supply this extensive field, and to operate the lamp, a ballast is necessary. The ballast is a very essential part of any fixture, since it is the device which regulates the amount of energy supplied to the lamp.

The simplest ballast is the series choke or reactor. It has a core composed of a large number of thin sheets of high grade magnetic steel. Around this core is wound a coil of many turns of insulated copper wire. This core generally contains an air gap, or series of air gaps, which are used to accurately set the reactance or choking effect, and causes the lamp to operate at its rated current and watts.

Because of the multiplicity of fixture designs, supply voltages and frequencies encountered, many designs of ballasts are necessary. Also ballasts may operate more than one lamp, and be equipped with capacitors to improve the operating power factor.

Ballasts today should meet rigid specifications established by the Underwriters' Laboratories and by the lamp manufacturers. For trouble-free service these units must be used in well designed fixtures. Also the fixtures must be installed properly and serviced correctly.

In performing these operations, two characteristics of a ballast must be given first consideration. These are noise and heating. The following suggestions are based on the observations and tests of many fixtures.

1. Noise

All alternating current devices generate a certain amount of hum, or noise, which is characteristic of the frequency of the supply line. Most commercial circuits are 60 cycles, that is, the voltage varies from a maximum value positive, to a maximum value negative, 120 times a second, and any equipment connected to such a line must be able to respond to the same variations. The magnetic core and surrounding metal, such as the case, even though thoroughly anchored, will nevertheless hum slightly.

The slight amount of hum can easily be amplified in certain fixtures, since the fixture with its reflector acts as a loud speaker. Fixtures made of light-gauge metal have been the source of considerable trouble. Also, loose parts of a fixture, such as end decorative pieces, reflectors, and even loose lamps, can cause considerable amplification of ballast hum.

Wherever possible, sturdy housings should be employed. All parts should be securely held, and the ballast so mounted that a minimum of hum is transmitted to the fixture.

Hum transmission can be reduced by mounting the ballast on sound absorbing washers, or pads such as cord, felt, and asbestos. It is usually not enough to simply place washers under the mounting feet and then permit the head of the mounting bolt to rest directly on the top of the mounting foot. The head, as well as the base, should be insulated. Where fixtures are to be mounted in very quiet locations, it may be necessary to suspend the ballast on springs, or some other type of suspension, which keeps the ballast away from all fixture parts. In extreme cases the ballast may be located away from the fixture. It is suggested that the lines supplying the lamp from the ballast be not more than 50 ft. long and at least No. 14 AWG wire.

2. Heating and Ventilation

Ballasts, in addition to the iron and copper previously mentioned, generally contain considerable quantities of paper. This paper is used to insulate the layers of copper wire, provides insulation barriers, and is used extensively in capacitors. It is obvious that if the temperature of the ballast becomes too high, the paper will char and lose its insulating properties. This may render the unit inoperative or allow excessive currents to flow, thus creating a fire hazard. The insulation on the lead wires might also be destroyed by heat, causing a short circuit. The high temperature may not cause immediate failure of the ballast, but will shorten life due to incipient damage causing progressive deterioration and eventual failure.

Fixture tests have shown that if the ambient temperature around the ballast is kept below 50 C. for normal fixture operation, satisfactory operation of ballast equipment can be expected. However, if the ambient exceeds 50 C. consistently, the insulation life of the materials in the ballast will be shortened. Elevated ambients also increase the possibility of compound exuding from the ballast.

In any case, the cooler a fluorescent ballast can be made to run, the longer and more trouble-free life it will have. Of course, the temperature rise of the ballast itself is governed by its electrical design; however, the ultimate temperature of the ballast in a fixture depends on the fixture design.

Ballast Installation Problems

By C. W. Kronmiller
Specialty Transformer Engineer, General Electric Company

Ballast compartment ambient is produced by heat generated by the lamps and by the ballasts. Both must be considered in the design of the fixture if safe compartment temperatures are to be obtained.

The following suggestions may be applied to fixtures to effect reductions in temperature.

1. Where only a slight decrease in temperature is required, it may be obtained by painting the inside of the ballast compartment in dull black.

2. The ballasts can be mounted flush against the fixture instead of on washers as is often done to reduce noise. This will effect considerable temperature reduction because of the increase in conduction. If the noise is objectionable or excessive, the ballast may be mounted flush on as large a sheet metal plate as can be put in the fixture, and then the plate mounted on washers. The plate increases the area of the surface and consequently increases the heat dissipation.

3. An increase in the size of the ballast compartment will sometimes give a reduction in temperature.

4. Where more than one ballast is mounted in a fixture, their position may influence heating appreciably. They should be mounted as far away from each other as practical. Also, if one end of the ballast tends to run hotter than the other, as is the case where a capacitor is included in the box, they should be mounted with the hotter ends away from each other. This conforms with the practice of mounting them as far apart as possible.

5. Ballasts will operate cooler if mounted against the top of the fixture because it is generally the coolest surface, being further away from the heat of the lamps.

6. Another method of cooling is by ventilation. If holes or louvres can be placed in the top and bottom of the ballast compartment, a chimney effect will be obtained which will tend to draw air past the ballasts and cool them.

7. Sometimes the lamps are enclosed in glass or translucent covers. These covers trap the heat emitted by the lamps, thus raising the temperature of the ballast compartment. End ventilation by means of holes or decorative louvres is of some assistance; however, more effective reductions can be made by providing openings in the bottom of the covers and at the top, on each side of the ballast compartment. This permits air to circulate around the lamps.

8. Ballast temperatures can be materially reduced if the fixture design is such as to permit the ballasts to be mounted externally, or exposed. They should be mounted flush against the supporting member so as to gain the increased radiation area afforded by the supporting surface.

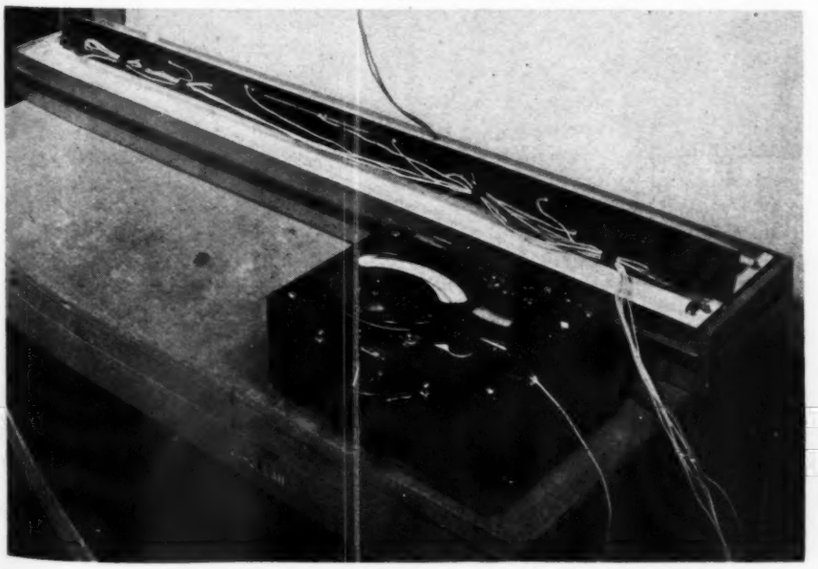
9. Generally speaking, fixtures suspended from the ceiling run cooler than those mounted directly against the ceiling because the air can rise instead of being trapped by the ceiling.

These, and no doubt other ways and means of mounting ballast equipment, will suggest themselves to the fixture designers. Ballast construction and ballast installation play such an important role in efficient operation of fluorescent lighting systems, that the time and effort required to carefully select parts of high quality is well justified.

Independent testing groups, such as Electrical Testing Laboratories, Inc. of New York City, have definite specifications which ballasts must pass in order to be certified. These specifications are written by leading lamp manufacturers, and a ballast, to carry a certification label, must be constructed so that its operating characteristics will match those of standard lamps, insuring good operation and rated output at minimum cost.

Recourse to these available data when planning a fluorescent system, will eliminate many unnecessary operation and cost headaches at a later date.

FLUORESCENT FIXTURE *with wiring channel laid back to show ballast position. Ballast temperature readings are being recorded on the thermocouple potentiometer.*

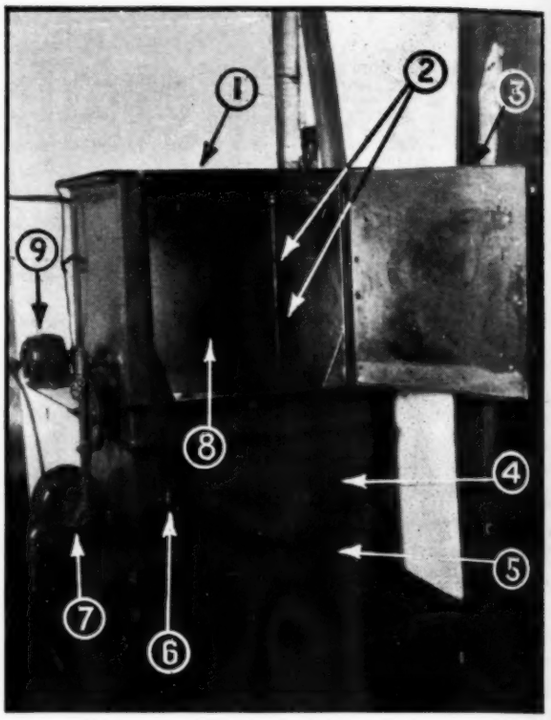


AUTOMATIC Pressure Cleaning

A motor shop in Cincinnati has developed an automatic liquid pressure cleaner that saves time and labor on motor repairs.

By Shelden F. High

Sullivan Electric Co., Cincinnati, Ohio



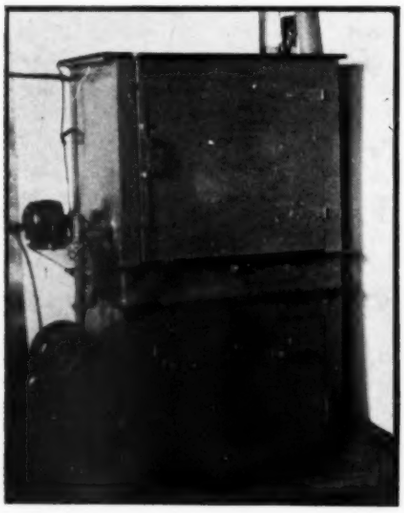
SALIENT POINTS *of this automatic pressure liquid cleaner are (1) hinged top; (2) adjustable spray nozzles: (3) swinging doors; (4) filter drawer; (5) fluid reservoir; (6) opening for hand nozzle attachment; (7) circulating pump; (8) revolving work turntable; (9) turntable motor.*

MOTOR service shops are always on the alert for ideas and improvements that will reduce cost and time and increase the quality of their repair work. We had been contemplating the construction of a liquid pressure cleaner for some time. After investigating several types designed by members of the Certified Repairs Plan of the National Certification Board, NISA, we decided on one that uses a cleaning fluid squirted under sufficient pressure to remove the heavy film of grease and dirt on the motors and still leave the liquid free to dissolve grease particles.

The pressure cleaner is totally enclosed with the motors mounted on the exterior. The actual cleaning chamber is approximately 36-in. square by 31-in. high and will take motor stators up to 25 hp., 1,800 rpm. in size. Two hinged doors, one on the top and one on the front of the unit permit easy access to the cleaning chamber. Two adjustable nozzles mounted in each of the four corners direct sprays of cleaning fluid under 30 pounds pressure on the work revolving on the turntable.

The circular turntable is of an open grate type and is supported on a self-aligning main bearing. Each of the four walls of the chamber are equipped with a spindle and small ball bearing to take care of the tilt of the revolving table which is operated at five rpm. by ¼-hp. motor with a V-belt and worm drive.

A one hp. motor connected to a gear type pump circulates the cleaning fluid from a reservoir in the base of the unit. The used fluid returns through a filter consisting of a removable drawer filled with soft wood shavings topped by a 100 mesh screen and a 16 mesh screen. The two screens can be removed periodically and cleaned. The wood shavings, which do an excellent job of removing the heavier grease dissolved by the cleaning fluid, can be replaced after long intervals. The solution chamber has a capacity of approximately 50 gallons and contains an opening for the use of a hand nozzle for any necessary hand spraying.



DURING OPERATION *the cleaner looks like this. Flanged door seals keep the cleaning fluid spray within the cleaning chamber. After the allotted washing time the motors are shut off, door opened and the equipment removed.*

The operation of the cleaner is entirely automatic. Once the equipment is placed on the turntable, the doors closed and the motors started, the mechanic can return to other productive work instead of watching the cleaning operation. As the work revolves on the slowly rotating turntable, high velocity jets of the cleaning fluid impinge on it in various vertical angles, dislodging the grease and dirt particles on the equipment. Any vapors that might be given off are removed from the cleaning chamber by a 4-in. vent pipe. Generally speaking, about 10 to 15 minutes is required to do a thorough cleaning job in all respects. Small parts may be cleaned equally well by placing them in a wire basket and going through the same process.

The prime advantage of this newly developed cleaning unit, in addition to the size of equipment it can handle and the quality of the cleaning job it does, is the all-important fact that we now can divert much needed productive manpower to other work during the cleaning operations.

From a paper presented at Ninth Annual NISA Convention, Cincinnati

CUTLER-HAMMER MULTI-BREAKERS IN

"HOMES AT WHOLESALE"

HOMES for war workers, homes with every modern convenience, "Homes at Wholesale" . . . that is the story of a project involving hundreds of popular priced two and three bedroom dwellings now going up in the southwest portion of Los Angeles and thousands more to go up in other parts of the city. Modern manufacturing, merchandising and marketing methods on the part of the Marlow-Burns Development Company and J. Paul Campbell, the builder, are responsible for the success of this vast project.

As you would expect, you will find a Cutler-Hammer Multi-Breaker in every one of these homes, necessary protection with modern convenience *using a minimum of scarce materials.* Builders and contractors who have an equally keen sense of today's conditions are selling such jobs . . . in a market that has been *cultivated* by Cutler-Hammer National advertising and *convinced* by Cutler-Hammer Multi-Breaker dependability. Push the C-H Multi-Breaker and feel the power of a known name and product. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ont.

● *One of many war-time housing projects using C-H Multi-Breakers. Equal opportunities exist for you when you push C-H Multi-Breakers . . . accepted by all Housing Authorities.*

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CUTLER-HAMMER
MULTI-BREAKER
C-H

1892-1942 50TH ANNIVERSARY

Editorials

Design Must Adapt to Standards

The other day we had an interesting letter from one of those far off islands in the Pacific which have climbed out of the geography books into the headlines. The writer wanted suggestions on a particular type of control operation for a group of warning sirens.

He got the information, after much consultation, discussion and furrowing of expert brows, not because it involved a complicated electrical design, but because it had to be accomplished with the kind of standard equipment that would probably be available at one of our Naval outposts.

This is significant because it is the same kind of problem that electrical men are facing today in every part of the electrical construction and maintenance industry. We all must get along with a pretty narrow list of standard items. It is not enough to work out an ingenious solution to a problem in control or wiring system design on paper. It must stand the test of whether or not it can be accomplished with standard materials and apparatus.

Conserve Rubber Tape

The seriousness of the rubber situation is painfully apparent. We must go all-out in our effort to conserve rubber in any way shape or form. Conservation of that live stretchy rubber tape, used so extensively in the electrical industry, is one way in which we can all pitch in. And that doesn't mean skimping on insulation—for we can't afford to pit safety against frugality. It simply means reducing waste —those "couple of inches" discarded when splices or connections are made.

One way of aiding rubber tape conservation comes in the form of a suggestion from the Electrical Contractors Association of City of Chicago. This calls for the scoring of the linen backing of the rubber tape about every three inches—this amount, when stretched, being enough to adequately insulate small wire splices under average conditions. Larger cable splices would require proportionately more. Such scoring would show the mechanic how much tape to use and may even prove to be a psychological hazard—making him feel a bit guilty if he uses more than is required.

It shouldn't be too difficult a problem for manufacturers to score tape in this fashion. It would do much to make the roll last longer and be a worthy contribution to our conservation program. It would be a step in the right direction.

Maintenance Opportunities

Within the past few months two plants were destroyed by fire—the cause of which was tentatively charged up to "a short circuit." One was a large warehouse on the east coast; the other a war plant in the midwest. Whether or not the cause of the "short" was lack of maintenance, we don't know. We do know that the plants were gutted, material lost, and in one case machinery destroyed that may be irreplaceable.

Even warehouses and storage spaces need maintenance and inspection. For the destruction of stored goods is another means of slowing up our war effort. There are many such storage plants and small manufacturing plants throughout the country where a maintenance contract with an electrical contractor might solve the problem and provide the necessary protection.

Contractors might venture to set up such maintenance services in their own industrial areas. These opportunities won't come over the transom. We've got to go out and find them—sell our services. One contractor could maintain several plants or warehouses. It's an opportunity we can't afford to miss.

Silver Busbar

Practically all of the silver produced in this country is sold directly to the U. S. Treasury as a monetary base. The bars are stored away in vaults under heavy guard.

As a support for our system of currency and commerce we'll take the word of our economists that this silver is immensely valuable even at its artificially maintained price of about double what it would bring in the open market. But the value is inherent in the stable molecules of the metal, not in the method of storage.

Our monetary base silver can be put to work directly in the war effort by casting it into heavy busbars, then leasing it to aluminum plants or other well guarded war industries for use in their electrical distribution systems. And tons of copper would be released for other use by this sane and practical plan. Some such use of our silver is already under way but the amount involved is apparently insignificant compared with the resources available. All of it ought to be used at once.

Over-Motoring Is Wasteful

With the critical copper situation facing us today, we are advised by L. A. Umansky of General Electric's industrial engineering department to follow the slogan "When in doubt use the next smaller rating" in the selection of motors. He points out that 25 per cent more materials and labor are now going into the production of motors than is needed for the work the motors are being called upon to do.

The WPB takes up the same idea in a release requesting closer motor-to-load application and urging overloading as preferable to "over-motoring" under present industrial conditions.

The importance of minimum motor sizes is not solely because of the copper used in motor winding. Actually this is a small portion of the copper required for the machine. The bulk is in

the distribution system, in cables and busses and switchboards.

"Over-motoring" thus may require many pounds of copper more than closely designed applications. And in these days every ounce of copper saved is vital.

Problem of Support

The scarcity of critical materials has limited many conversion lighting jobs to existing outlets. And replacing obsolete or inadequate incandescent units with fluorescent fixtures can often provide an important increase in illumination even though it may not be possible to reach recognized modern standards.

Common problems in such a change-over are the strength of the available supporting studs and the anchoring of the outlet box. The ease with which fluorescent units may be used to replace existing equipment often obscures these minor questions. But they are important. Every job requiring the use of existing outlets for suspending fluorescent fixtures should be carefully checked. Strengthening box supports or provisions for separate suspension may amount to a sizable cost item.

Allowable Costs Defined

One of the persistent headaches of government contract work has been the difficulty of squaring actual cost items against the accounting practices of government bodies. On fixed fee contracts especially a clear understanding of what constitutes allowable performance cost items and expenses of an administrative and distribution nature should be clearly understood at the time of bidding.

A new government pamphlet gives us for the first time in printed form a definite outline of what are considered permissible costs in contracts with the Army, Navy or Procurement Division of the Treasury Department. The pamphlet is entitled "Explanation of Principles for Determination of Costs Under Government Contracts" and is available for ten cents from the Superintendent of Documents, Washington, D. C.

Every contractor handling government work should obtain a copy.

Tools Are War Weapons

Tools are to the contractor what guns are to the soldier. And the soldier makes sure his "shootin-stick" is in tip-top shape before he goes over the top. The contractor has the same responsibility of keeping his tools in first-class shape during the length of the job. With dull tools, progress is impeded, construction lags and before we know it we're in trouble.

One large middle west electrical contractor attaches so much importance to the condition of his tools that he employs one man whose sole duty is to maintain job tools in first class condition. When drills, dies, and cutters become dull or show signs of breaking down, he's on the job sharpening, repairing or replacing them. It's a full time job, but it pays big dividends—mechanics are happier and do better work, the job speeds on and before we know it construction schedules are shattered. We can't win on the battle-front or the home front unless we keep our weapons of destruction and construction in working order—always.

Price Control Progress

As we go to press, the price control picture for the electrical contractor shows little change from the uncertain conditions of the last few months. Technically, General Maximum Price Regulation No. 1 is the applicable provision. Consumer Services Regulation No. 165 has been revised, as we predicted last month, to cover services at the commercial and industrial levels. But building services are specifically omitted from the amendment and "remain covered by the General Maximum Price Regulation No. 1 until special regulations applicable to them are issued."

Since materials are controlled at the manufacturing and distribution level and wage rates are under the eye of the War Labor Board, the contractor's practical responsibility for holding inflation in check appears to be limited to his markup and profit methods. In any case, these should be held at the March 1942 level or under. Until specific regulations for building services are issued the best practice is to follow the instructions of the local OPA field offices.

For those operating motor shops or handling "machinery services," the rules set forth in Maximum Price Regulation No. 136 apply specifically. Special attention should be given to Section 1390.9 of that regulation which sets the base date at March 31, 1942.

The problem of setting price ceilings in an industry as complex and varied as ours is not easy. However, it is not likely that OPA will crack down on anyone who unwittingly violates the rules if there is evidence that he has made a sincere effort to operate under the General Maximum.

New Rules Appoved

In our news section this month, the activities of the Emergency Committee in formulating new Code rules is reviewed in considerable detail. All of the interim amendments approved up to August 15, which have not appeared in previous issues of *Electrical Contracting,* are included here. Other amendments will be published as they are approved.

Every effort has been made to bring these amendments to you in the exact original phrasing and we hope that this will provide rapid, industry-wide distribution. We suggest that you keep this material for reference until an official supplement to the Code is printed.

Spring Cleaning

How many motor shops, contractors and plant electrical departments have completed "spring cleaning"? If it hasn't already been done, now is the time to do it—Uncle Sam needs the scrap.

The amount of scrap that can be accumulated over a period of years is truly amazing. Arthur Wagner Co., Chicago motor service organization, recently cleaned out 20 years accumulation of obsolete and damaged equipment. When he finished he had sold 156½ tons of scrap motors, pulleys, pipes, boxes, grids, gears, etc., to Uncle Sam. That's a lot of scrap.

Surely there are other shops, no matter how large or small, who have scrap equipment that "never did get moved." We should take time to "clean house" now. We'll be helping our country and freeing littered storage space for more essential use. It's good business as well as a patriotic responsibility.

New VICTORY

with

NON-METALLIC REFLECTORS

Three Advantages Are Combined in the fluorescent fixtures comprising the Day-Brite Victory Series: (1) High reflection values and long life are assured by Day-Brite's "Super-White" baked enamel finish . . . (2) Speed in installation and ease of servicing are achieved through simplified mechanical design . . . (3) Maximum rigidity of the entire installation is assured by truss-like construction.

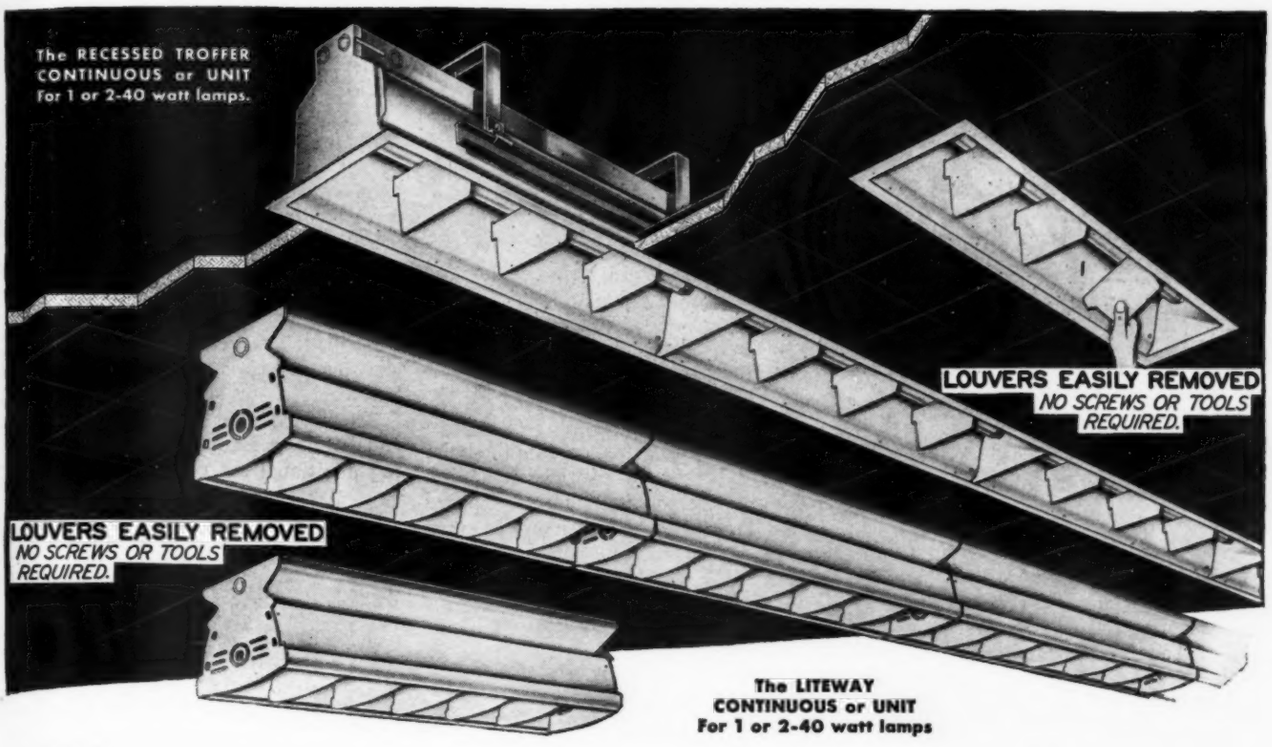
The DAY-LINE . . . CONTINUOUS with "ICE-TONG" HANGER CLAMPS

For Industrial Applications, the Day-Line System of continuous lighting provides a flexible method of installing long, unbroken lines of luminaires. Foot-candle intensities can be easily regulated by varying the number of lamps used, or by spacing the reflectors at intervals on the wiring channel. Installation is particularly simplified by Day-Brite's exclusive "ICE-TONG" Hanger Clamps.

LOW COST INSTALLATION SPEED with "ICE-TONG" HANGAR CLAMPS

It is unnecessary to spot exact center locations for these "one-position" mounting hangers. For any type of suspension, they are merely positioned at any point parallel with the length of the channel. The jaws of the hanger receive the channel and hold it in place (like an ice-tong holds a block of ice). Turning down one screw rigidly locks the hanger clamping jaw in position.

DAY-BRITE LIGHTING, INC., 5442 BULWER AVE., ST. LOUIS, MO.



SERIES FLUORESCENT FIXTURES

The RECESSED TROFFER

Especially adapted to initial installations in all acoustical type ceilings. Ideal for long continuous runs, or unit applications. Louvers are quickly removable for speed in servicing or re-lamping.

The LITEWAY

In essential respects similar to the Recessed Troffer, except that the LITEWAY is specially designed for quick mounting on existing ceilings of all types—either in long continuous runs or units.

VICTORY BEGINS WITH LIGHT

Light is the Nation's No. 1 production tool! Make the Most of the Best of it . . . Specify Day-Brite Victory Series Fluorescent Fixtures. . . . Call Your Day-Brite Engineering Representative.

DayBrite Rivals Daylight

Adds Victory Hours!

Patent Nos. 2,281,346, 130,740
Other Patents Applied For

Day Brite
FLUORESCENT
FIXTURES

56

The COMPLETE LINE OF FLUORESCENT LIGHTING FIXTURES *Nationally distributed through all leading electrical supply houses*

Motor Shops

HOIST STRIPS STATORS

An electric hoist and a specially designed bench is used to strip motor stators in the stripping department of the motor repair shop of the J & H Electric Company at Providence, R. I.

The bench consists of five pieces of 3-inch I-beam spaced several inches apart and welded to two I-beam cross pieces. Four I-beam legs support this bench top. A conventional building jack is mounted inverted to the bottom of the bench and has three chains fastened to it. These chains lock into suitable slots on three S-shaped hooks which hold the stator.

***STRIPPING BENCH** with a foot-controlled electric hoist makes short work of stator stripping at the J & H Electric Co. shop at Providence, R. I.*

The stator to be stripped has its coils cut on one side. It is placed on the bench and clamped down by the hooks which are made tight by turning the jack under the bench. A pair of parrot nosed jaws fastened to the electric hoist grip the coils which are pulled out by operating the hoist. Two footswitches, one for raising and one for lowering the coil grips, operate the hoist motor leaving both of the mechanic's hands free to manipulate the gripping jaws. The switches are mounted on a wooden platform on which operator stands.

By using this mechanism, a stator can be completely stripped in a few minutes.

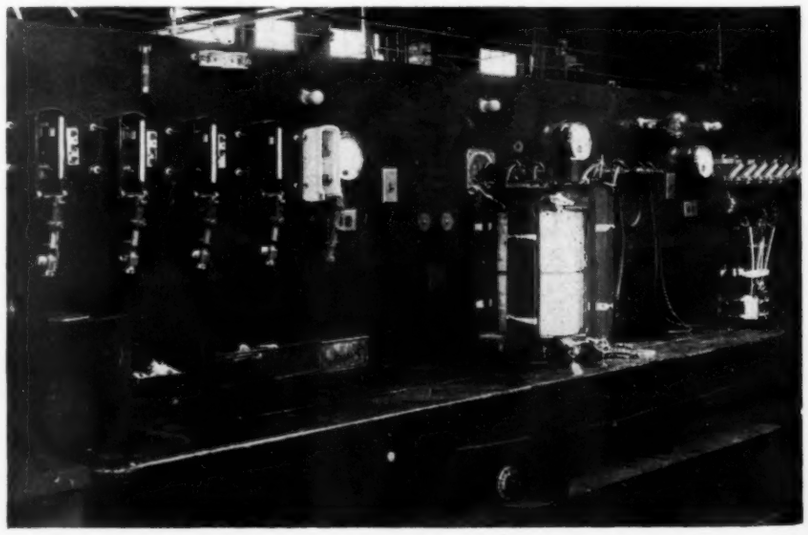
HIGH VOLTAGE TEST BOARD

A high voltage test board is the latest addition to the transformer repair department of Anderson's, Inc., Nashville, Tenn. motor service shop. Now tests up to 30,000 volts can be made on transformers coming into the shop.

The board is divided into two sections, the left being for the test transformer connections and the right section taking care of test loads and switches, output voltmeter and ammeter. The porcelain enclosed fused cutouts on the left section of the board are for making exterior connections on the test transformer. This unit is a 30 kva., voltage regulating transformer with a variable tap changer on the low voltage (input) side, providing steps from 80 volts to 240 volts. The high voltage range is from 1000 to 30,000 volts.

Of unusual interest is the safety features incorporated in the board. A magnetic contactor on the input to the voltage regulator can be opened by emergency stop buttons at the center and each end of the test bench. When open this kills the entire board. The contactor can be reclosed only from a center button.

The test prongs are mounted on the ends of long insulated "sticks" providing additional safety to the operator.



***HIGH VOLTAGE TESTS** on transformers are made safe and easy by this new test board in the transformer repair department of Anderson's, Inc., Nashville, Tenn. motor service shop. Top range is 30,000 volts.*

ARMATURE BENCH CRADLE

A portable small armature holder that can be used on any work bench has been built for shop use at the Chatta nooga Works, Chattanooga, Tenn.

The base is made of two short lengths of small H beam welded to conduit end pieces. Two short conduit uprights are welded to steel blocks which ride

***BENCH CRADLE** for small armatures can be moved to any desired working area in this shop. It can be adjusted to accommodate various sized units.*

AN ELECTRICAL WHOLESALER HELPS SPEED WAR PRODUCTION

WESCO teamwork met "impossible" air base test

WESCO SPEEDS PRODUCTION

* War plant manufacturing basic ingredient of TNT got needed equipment from Wesco in 2 days. Manufacturers promised delivery in 8 to 15 weeks.
* Airfield was saved 81 days' delay on delivery of 68 electrical items. Fastest complete delivery by manufacturers was 12 weeks. Wesco required only 3 days.

WESCO SERVES BUSINESS

* By assembling all parts of an order in one shipment.
* By furnishing informative and technical data.
* By knowing local and national codes and rulings.

The name that means everything in electricity

Five Houses Pooled Stocks and Supplied 14 Products in Quantity in 12 Hours

At a new Marine Air Base on the Southeast Coast, office buildings sprouted over night. Even roofs were in place but no order had been given for electrical equipment. At 3 P. M. one day the contractor handed the complete bill of material to the local Wesco House and required delivery the next morning.

Fourteen different products were involved, all in quantity. Included were 200—40-Watt Fluorescent Industrial Units, 12 transformers of 3 types, panels, safety switches, cable, conduit and fittings. Local stocks could furnish some of the items. Telephoning the 4 nearest Wesco Branches, the local House rounded up the complicated order, piecemeal. Everything started forward that afternoon and the contractor went to work the next day.

Wesco teamwork has performed many "impossible" tasks for industry. Today that ability speeds the war effort—but it will again serve business in the reconstruction to come.

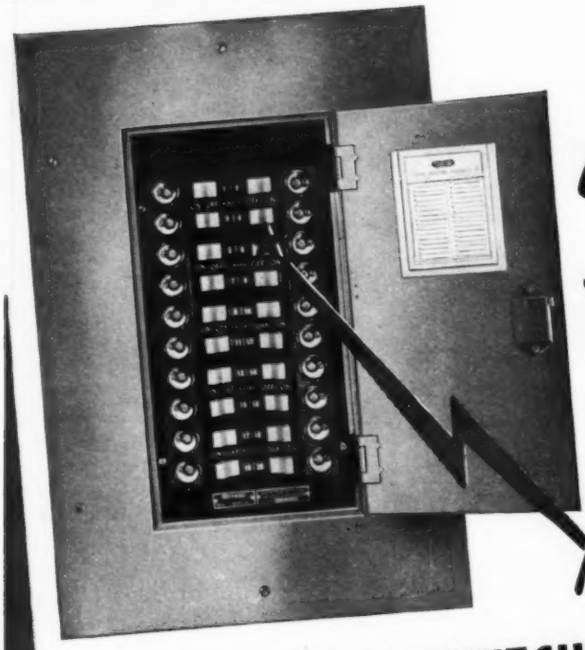
Westinghouse

ELECTRIC SUPPLY CO.

150 VARICK STREET · NEW YORK, N. Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 79 BRANCHES

FEDERAL
ELECTRIC PRODUCTS



at this point

THE "SAFETY SWITCHMAN"
CARRIES THE LOAD

In Federal Panelboards, the "Safety Switchman" is an ingenious switch that stands constant watch ahead of every fuse. This means a higher safety factor and perfect control protection of lighting and small power circuits. Federal Type NTPR Panelboards—to handle from 4 to 40 circuits—are compact, ruggedly built, and approved by Underwriters Laboratories. They have quality construction features that you'd expect would cost considerably more. *For complete Federal panelboard specifications, write for Bulletin No. 21-40.*

FEDERAL PANELBOARD FEATURES

Shallow Boxes for Thin Wall Mounting • Large Wiring Gutters
Flush Locks and Catches, Concealed Hinges • Plenty of Knockouts
Solderless Terminal Connectors • Rugged Construction
Giant Switches • Low Cost

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
50 PARIS STREET, NEWARK, N. J.

Motor Shops

[FROM PAGE 32]

the inner channels of the two H beams. Steel plate clamps hold the uprights in any desired position. Welded to the tops of the pipe uprights are a live center and a dead center to hold the armature shaft. A screw knob on the live center takes up any necessary adjustments.

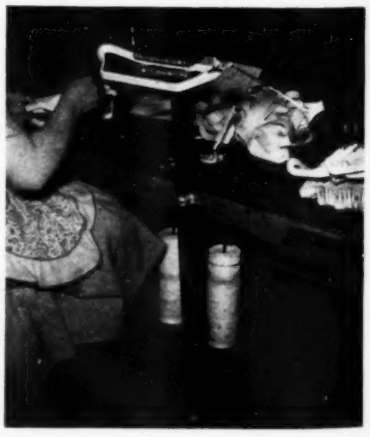
Armatures up to 10-inches in diameter and shafts up to 36-inches in length can be supported in this cradle.

COIL GRIP

The Excel Electric Service Company, Chicago motor service shop, tapes a large number of their formed coils by hand. Through experience, they have discovered that it can be done just as quickly as by machine.

To facilitate this taping operation they have designed and built a coil grip that rigidly holds the coil while the operator manipulates the tape. The grip consists of two pieces of tape-wound flat iron; the bottom piece welded to a pipe standard, the top welded to a steel rod which telescopes into the pipe. An old cone pulley serves as the base of the standard.

A spring operated foot pedal is connected to the telescoping rod which extends the length of the standard. Pressure on the foot pedal raises the upper jaw of the grip; the coil is inserted; and release of the pedal permits the spring to close the jaws, gripping the coil rigidly. The pressure is not sufficient to injure the coils. A two-hole pipe strap fastens the pipe standard to the edge of the work bench.



***VISE LIKE COIL** grip holds motor coils rigidly during the taping operation. The device is operated by a foot pedal and retaining spring.*

PUGET SOUND NAVY YARD
BREMERTON, WASHINGTON
SUPPLY DEPARTMENT
IN REPLY REFER TO
DIRECT ORDER
No. 9 NSA 82819
5/8/42
Coastal Sales Company
1001 Westlake Avenue North
Seattle, Washington
RECEIVED
JUL 24 1942
LLOYD PRODUCTS CO.
PROV., R. I.
GENTLEMEN:
Please deliver the material listed as soon as possible, all transportation charges paid, to
Supply Officer, Puget Sound Navy Yard, Bremerton, Washington
Dealer to state here (----------DAYS) time required to make delivery.
ITEM No.
ARTICLES AND SERVICES
QUANTITY
Terms ---------- % Discount Cash
201 (17)
200
FLUORESCNET STARTER, for 48" tube.
Starter to be so constructed so that
it will detect a faulty lamp immediately.
If after several attempts, the lamp does not light properly, the
starting switch is cut out of the circuit automatically and remains
out until the faulty lamp is replaced with a good one. Starter to
be similar and equal to Lloyd Products Co., as sold by the Coastal
Sales Co., Seattle, Washington
NO BLINK STARTER
"NO BL
FS
Specified
REPEATEDLY
As the Standard of Quality and Performance.
The LLOYD NO-BLINK
Starters prevent breakdown of ballasts, condensers and starters themselves.
Prevent "flicker" and "blink".
Start quicker. Work better.
Last longer.
Listed and Approved by Underwriters' Laboratories Inc., and Canadian Engineering Standards Association.
Licensed under Westinghouse Elec. Mfg. Co. patents Nos. 2,200,443 and 2,228,210.
UL
CSA

Lloyd Policy Insures Quality

LLOYD PRODUCTS COMPANY

Box C — Edgewood Sta., Providence, R. I.

Representatives — Branch Offices — Warehouse Stocks in 23 Leading Cities

YOU CAN GUARANTEE THEM FOR *Longest* SERVICE LIFE••

ILLINOIS COMPLETELY INSULATED

ALL PORCELAIN WIRING SYSTEMS

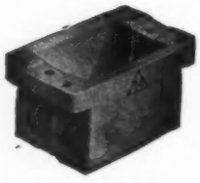
OUTLET BOXES AND COVERS

For the customer, porcelain protected wiring systems mean permanency of installation, economy, safety, dependable service where dampness and fire hazards are prevalent.

Illinois all porcelain wiring systems are adaptable to practically all wiring plans and layouts—they are easy to install and can be installed without grounding.

Porcelain is not a critical material—use it for your next installations.

STANDARD TUBES



SWITCH BOXES AND COVERS

★ SAVES VITAL MATERIALS • DO JOBS IN LESS TIME • CUT MAINTENANCE ★

STANDARD KNOBS

CLEATS

TOGGLE SWITCH PLATE

Bull Dog Trade Mark Registered

Look for this Trade Mark

LAMP HOLDERS

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS

Motor Shops

[FROM PAGE 34]

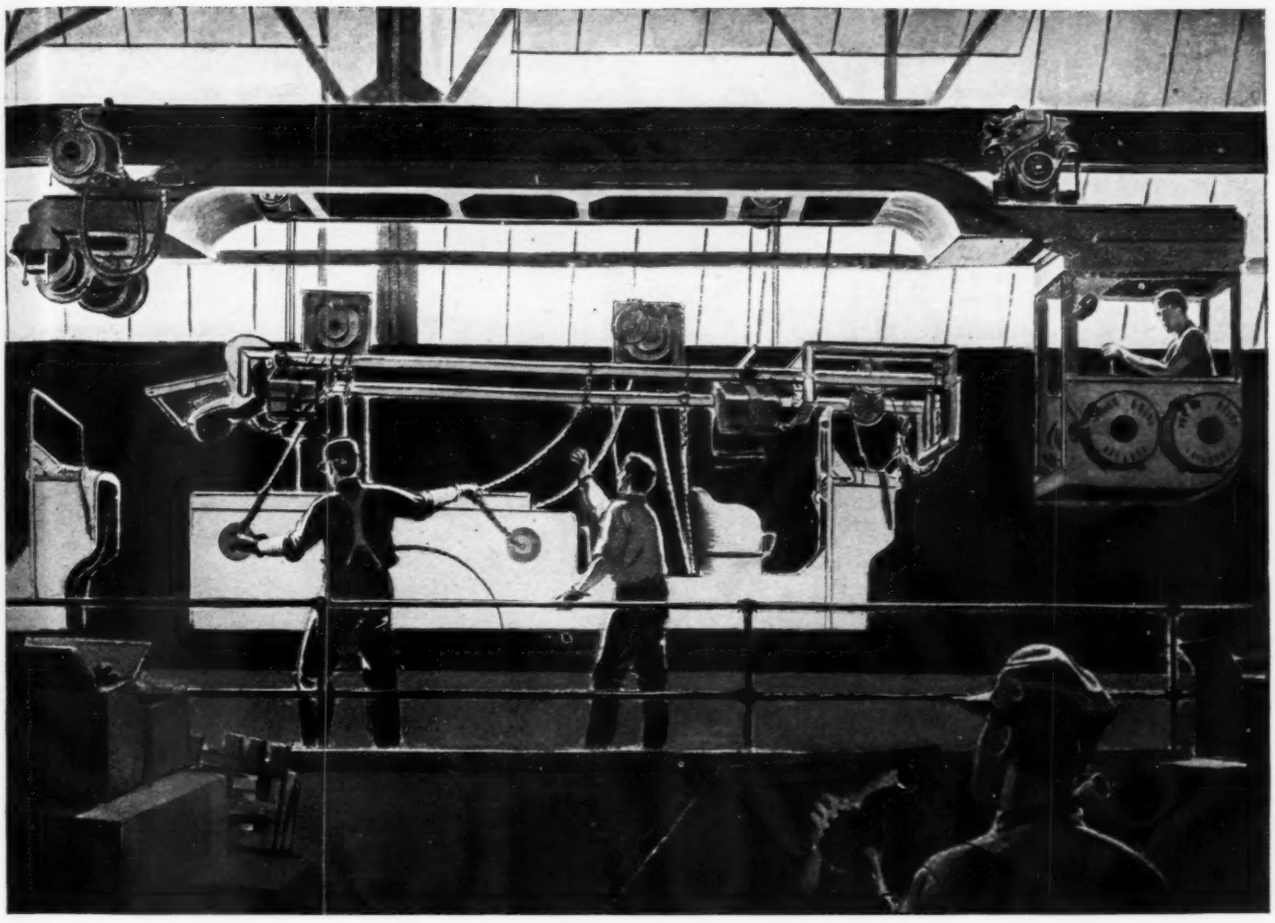
PROTECTIVE BOOTS FOR VISE JAWS

Many small parts with highly polished surfaces are handled in the electric motor and tool repair work at the Jay Electric Company, Detroit, Michigan.

To protect these parts from being nicked or scratched when placed in a vise, copper facing is used. Sheets of ⅛-in. copper are cut and bent to fit snugly around the jaws of the vise. Since copper is a comparatively soft metal, when the vise jaws are closed on a metal part, the copper instead of the part will take the beating.

***COPPER CUSHION** formed around vise jaws eliminates damage to metal parts in this repair shop.*

***HOLE FOR HEADROOM.** No, this transformer didn't crash through the floor of this repair shop. It was lowered into a 6-ft. deep hole in the floor of a storage building of the A. H. Nimmo Electric Co., motor repair shop of Detroit, Michigan, to provide the necessary headroom for replacing the burned out coils. The unit, a 500 kva., 4600v/440v single phase transformer, has a case height of about 9-ft. 3 in. Now that the emergency hole has been dug, it will be made a permanent feature of the shop.*



Converting to War Production—

DETROIT ENGINEER ELIMINATES FREQUENT INSULATION FAILURES

Hoist motors used to be rewound every 3 months because of overloads. Then engineers tried Fiberglas* with these results:

★ ★ ★

One a minute—night and day—truck bodies for the U.S. Army roll off the line of a Detroit plant. During manufacture, the bodies are shifted by electrically powered hoists. Under pre-war, 8-hour-a-day operation, overloads caused insulation failure in the 5 H.P. motors of the hoists about once every 3 months. Over a year ago, Fiberglas was adapted to the rewinds. Although the motors are now working 24 hours a day—7 days a week—overloads have not caused a single insulation failure.

★ ★ ★

PUTTING EXTRA MONTHS of service into motors and getting *more* than rated capacity from them is one of the most effective methods at our disposal for getting increased war production. In many cases resourceful engineers have secured results comparable to that of new equipment which wasn't quickly available.

And one method which they are skillfully utilizing to get these results is the application of Fiberglas electrical insulation—*in ever-increasing volume.*

In plane factories—munition plants—steel mills, for example, conditions of high operating temperature and overloading are more prevalent than ever before. These conditions frequently cause insulation failure in electrical equipment. Curtailed production results at a time when it's most needed.

Alert electrical men have repeatedly solved these problems by using Fiberglas as a component of the electrical insulation in motors, generators, and transformers of many varied types.

There is a Fiberglas product for every electrical insulation need . . . tapes, sleevings, tying cords, cloths, Fiberglas-backed mica combinations, and varnished cloths, Fiberglas-base laminated materials, saturated and varnished tubing, and Fiberglas-insulated magnet wire.

Consult your electrical manufacturer or service repair shop about Fiberglas electrical insulation. And if you are confronted with overload problems, remember how other engineers are solving these problems by gaining extra power with the help of Fiberglas. *Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

OWENS-CORNING

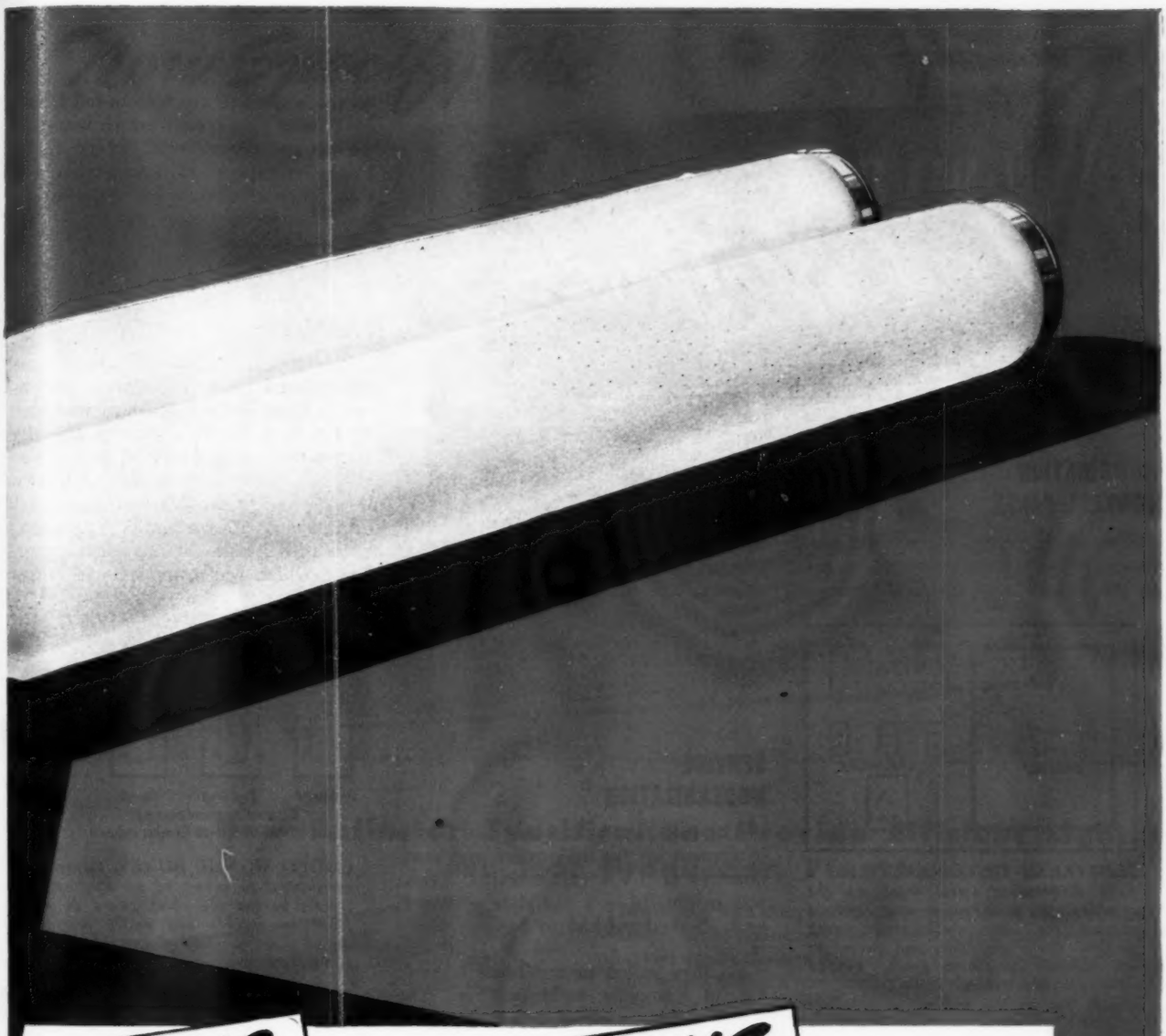
FIBERGLAS

*T. M. Reg. U. S. Pat. Off.

Again Westinghouse Reduces Prices!

This is the kind of news you don't expect to hear today. And it's good news for every user of fluorescent lamps. Prices have been reduced 12% to 17%, giving you even lower lighting costs, even more light for your money. Here again is proof of Westinghouse leadership in lamp design, research and manufacturing know-how. But lowered prices are not all. Quality has been substantially increased too. Today Westinghouse Mazda lamps give more light, last longer and cost less.

It's Westinghouse for



PLUS

In 1939
1880 LUMENS
Now
2100 LUMENS

12% Brighter Light

Technical improvements give you brighter light—in the 40 watt white lamp, for example, brightness is increased from 1880 to 2100 lumens —almost 12% more light for your money.

PLUS

A thousand Extra Hours of Life

In addition to lower costs and brighter light, Westinghouse fluorescent lamps now last longer than ever before—40 watt white lamps now have a rated life of 2500 hours —an increase of 1000 hours.

In 1939
1500 hrs.
now
2500 hrs.

FLUORESCENT

New low prices, on Westinghouse Mazda Fluorescent Lamps, effective September 1st

14-watt T-12 reduced from 80c to **70c**
15-watt T-12 reduced from 80c to **70c**
30-watt T-8 reduced from 80c to **70c**
15-watt T-8 reduced from 65c to **57c**
20-watt T-12 reduced from 80c to **70c**
40-watt T-12 reduced from $1.15 to **95c**
100-watt T-17 reduced from $2.60 to **$2.15**

The above prices are for daylight and white lamps.
Prices on Westinghouse soft white and colored fluorescent lamps are also reduced.

Prices on MAZDA H (MERCURY) also Reduced

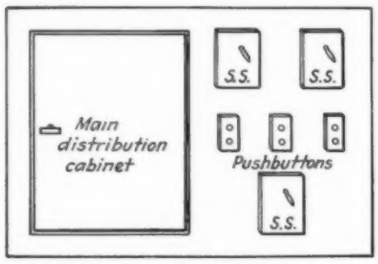
400-watt T-16 AH1 reduced from $11.00 to $9.50
400-watt T-16 BH1 reduced from $11.00 to $9.50
3000-watt T-9½ AH9 reduced from $45.00 to $40.00

Better Light at Lower Cost

WIRING Methods

COMBINATION CONTROL PANEL

The pump motors for the air conditioning system in a large plane plant in the Detroit area are controlled from



***SEMI-FLUSH DISCONNECTS** and a flush distribution panel make up the combination distribution and control cabinet for air conditioning pump motors. Only the doors and covers of the control equipment extend beyond the cabinet cover.*

a combination flush type distribution and control cabinet.

The cabinet, installed by the John Miller Electric Company, Detroit, electrical contractors on the job, consists of a dead front, enclosed, main distribution panel containing the circuit disconnects which occupies one half of the cabinet. The other half contains the motor disconnects and remote pushbutton controls mounted semi-flush in the cabinet cover. Only the doors of the disconnect switches and the covers of the pushbuttons extend slightly beyond the plane of the cabinet. This is to facilitate maintenance.

Flush cabinets of similar design are used for the control of other equipment in the installation.

SERVICE MODERNIZATION

The entrance service and distribution equipment for the main office and headquarters of TVA in Knoxville, Tenn., was originally in a sad state of confusion. Something had to be done about it.

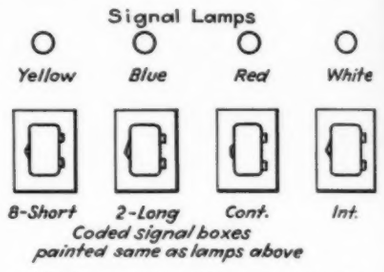
So they called in the Ideal Electric Co., of Knoxville, to clean it up. The old switches, meters, transformer enclosures, and jumbled exposed wiring were torn out and a new distribution center constructed. Now the new distribution system lines three walls of the room, starting with a main line switch and proceeding with frequent tap-offs along the wall to feed the various floors and power equipment.

All disconnect switches are mounted on the walls and are bottom-fed from a continuous steel trough which houses all wiring and connections. There are no live parts exposed to unauthorized persons. Feeder circuits leave the tops of the disconnects.

A. R. ALARM SIGNAL PANEL

A practical and simple control panel for industrial air raid alarms was recently installed in an eastern war plant by the E. J. White Company, electrical contractors of Newark, N. J.

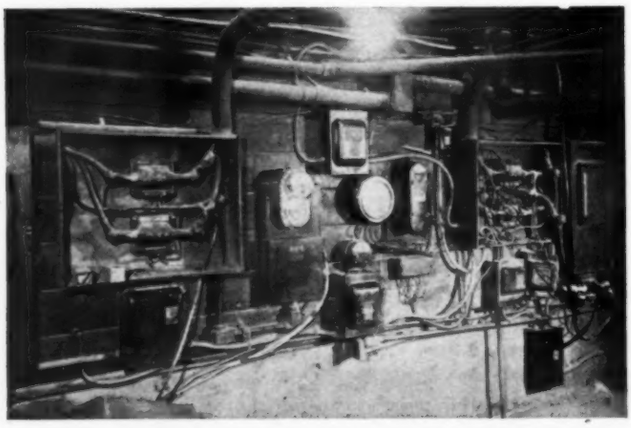
A coded signal on industrial howlers was desired to provide warning signals of an approaching air raid. The signals were to originate in the master guard house which was equipped with signal



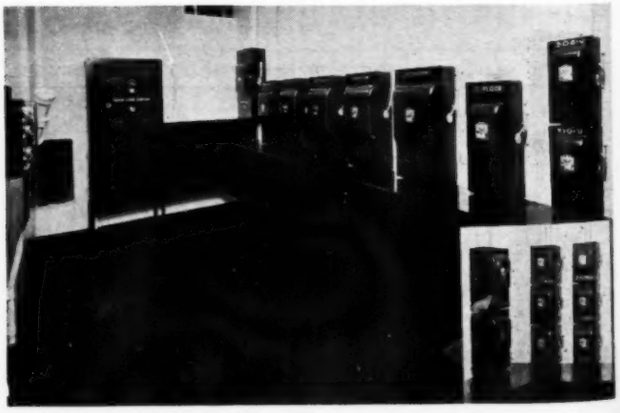
***CODED SIGNAL BOXES,** painted to correspond to colors of air raid signal lamps, permit the chief guard in this plant to quickly and easily originate coded plant air raid alarms. Industrial howlers in the plant are the alarm devices.*

lamps color coded in accordance with standard civilian air raid practice.

To provide the necessary coded signals to herald an approaching raid, four conventional coded signal boxes, similar to those used on fire alarm systems, were mounted directly under the signal lamps in the guard house. The boxes were painted the same color as the lamps—yellow, blue, red and white. The control



***BEFORE MODERNIZATION** this jumbled mass of wires, switches, transformers and meters presented an eyesore in the electrical service and distribution room.*



***AFTER MODERNIZATION** the room looked like this. A carefully planned and well designed service layout presents this picture of cleanliness, order and efficiency.*

Now Specify the

NEW *type V* Benjamin Fluorescent Units

for Productive Lighting

New Reflector Specifications Provide Efficient Lighting for War Production Plants . .

IN keeping with the program to conserve steel vitally needed for ships, tanks and other war materials, it is now recommended that you specify the new Benjamin "Type V" Fluorescent Lighting Units which utilize a new, highly efficient, non-metallic reflector. These new units are available for either 48" or 60" fluorescent lamps in both the individual open end units (Twin-Flo, Triple-Flo) and the continuous channel, open end units (Lite-Line System).

High Lighting Efficiency

"Type V" units can be depended upon to meet, efficiently and economically, the needs of plants engaged in war production for the high lighting levels and the exceptional seeing comfort that is provided by fluorescent lighting.

Guaranteed by Benjamin

These "Type V" units meet war production plant requirements for good fluorescent lighting. The lamps are adequately shielded for eye comfort. The reflection factor is 80% or more. The reflectors, auxiliary control equipment, sockets and other component parts are engineered for coordinated operation to provide maximum light output and trouble-free operation. "Type V" units are warranted to comply with all recognized illumination, electrical, mechanical and performance standards.

Let Benjamin Help You Meet Productive Lighting Needs

Through these new "Type V" units, Benjamin fluorescent lighting equipment is available to solve many lighting problems confronting plants engaged in, or converting to, War Production. Keener eyes are vital in the production drive, because basic to all production is the ability of the employees to see quickly, accurately and easily. Never has the need for good seeing been greater. Night shifts, six and seven day weeks, and sustained high speed production, have put a tremendous tax on the eyes, health and energy reserve of the worker.

Importance of Fluorescent Lighting to Production Drive

Benjamin "Type V" units provide the amount of light and the quality of lighting needed by the employee to perform efficiently, the seeing task which is part of the work he performs. Such lighting plays a most important part in alleviating the tax on the eyes, in improving the seeing ability, and in minimizing fatigue.

Send Today for New "Type V" Bulletin

For more details concerning the new "Type V" Benjamin units, write for new "Type V" Data Bulletin and a copy will be sent you promptly without cost or obligation. Address Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Illinois.

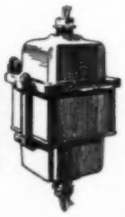
BENJAMIN TRADE MARK *type V* **FLUORESCENT LIGHTING EQUIPMENT**

DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS

AmerTran is improving its product to meet the exacting needs of today . . . tomorrow you will reap the benefit.

AmerTran power transformers available for all requirement in sizes to 10,000 KVA.. 132 KV.

AmerTran distribution transformers of either oil or non-inflammable-liquid immersed type available in sizes to 500 KVA.. 72 KV.



AmerTran air-cooled transformers for either indoor or outdoor service are available for all industrial requirements — sizes to 150 KVA.

TODAY . . . our entire plant output is being devoted to one purpose . . . to help win the war. Transformers of every type and description are being required in larger quantities than ever before, not only by government departments but also by defense plants and electric utilities. AmerTran is doing its share to meet this demand . . . we are developing improved designs and improved manufacturing methods . . . we are increasing our personnel and facilities . . . in short, we are shipping more and better transformers.

TOMORROW . . . when our bombers pull victoriously out of their last dive, the resumption of peace time demands will find AmerTran equipment far better than ever before. During these days when customers without priorities are deprived of transformers, we are supplying the exact same type of product as previously, and are developing improvements at a more rapid rate than usual. Customers of the future will benefit from these developments.

AS for the past 41 years, AmerTran will continue to hold the place of leadership in the communication field it has gained by the high excellence of transformers supplied for all electronic and radio applications. Manufacturers with sufficient priority rating are invited to discuss their transformer requirements with us now . . . all others must wait for victory.

AMERICAN TRANSFORMER CO.,
178 Emmet St., Newark, N. J.

Manufactured Since 1901 at Newark, N. J.

AMERTRAN

AmerTran Transformers are built to meet your exact Electrical and Mechanical requirements.

WIRING Methods

[FROM PAGE 40]

circuit was fed by a separate 2300 volt primary, single-phase transformer connected to the incoming high line ahead of the main switch.

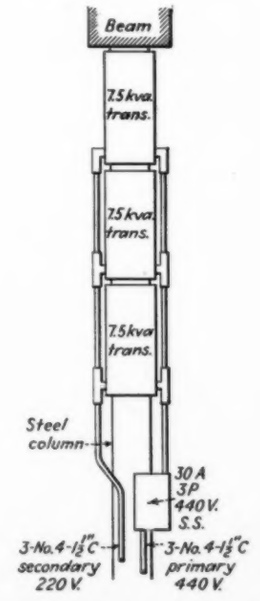
The system operates as follows: When the signal lamp flashes in the guard house, the guard pulls the lever on the yellow code box under the lamp and the howlers in the plant wail forth eight short blasts. If the blue lamp flashes, he pulls the lever on the blue box and two long blasts are emitted. And so on with each signal; the red code box gives a continuous blast and the white one an intermittent one, designating an all-clear.

Thus definite signals, coordinated with the color coded lamps, can be produced to warn employees of the approaching stages of any attempted air raid, without the necessity of any special equipment.

TIER MOUNTED TRANSFORMERS

When the Associated Electric Construction Company, Melrose Park, Illinois, joint venture contractors on a defense plant, encountered space limitations in a blueprint room, they mounted the necessary bank of transformers one above the other.

This tier method was used on a steel column. The 440 volt primary feeds entered the transformer connection

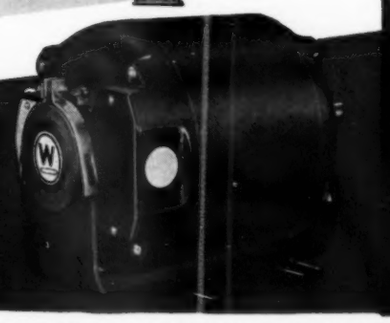


VERTICAL BANK of transformers, mounted on a steel column eliminated supporting rack and saved much needed space.

HORSECOLLARS and HORSEPOWER

A HORSE HARNESSED BETWEEN THE WAGON SHAFTS DOES HIS BEST WORK BY PUSHING HIS WEIGHT FORWARD INTO HIS COLLAR . . . AN ELECTRIC MOTOR DOES ITS WORK BY TURNING THE ROTOR . . . OFTEN THERE IS END THRUST, TOO . . . END THRUST IN ELECTRICAL HORSEPOWER THOUGH, DOESN'T DO ANY WORK, AND IT'S NOISY . . . TO GET RID OF THE NOISE WESTINGHOUSE BUILDS "NO BUMP" BEARINGS INTO EVERY ONE OF ITS SMALL SLEEVE BEARING MOTORS. THESE ABSORB ALL END THRUST SHOCKS . . ALSO, WOOL YARN SATURATED WITH NON-OXIDIZING OIL IS PACKED IN THE LARGE OIL RESERVOIR TO GIVE MONTHS OF LUBRICATION WITHOUT RE-OILING . . . DETAILS? . . . SURE . . . BUT IT'S BECAUSE WESTINGHOUSE PAYS ATTENTION TO DETAILS . . . THAT YOU CAN BE SURE OF STEADY, LONG-LIFE SERVICE

J-03169



Westinghouse

SMALL MOTORS

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, EAST PITTSBURGH, PENNSYLVANIA

RUBBER COVERED POWER CABLES • BUILDING WIRE

EVERY MAN, WOMAN & MACHINE
at
CRESCENT

is working 100% to keep the
Light of Freedom burning!

CRESCENT INSULATED WIRE & CABLE CO.

CRESCENT
WIRE and CABLE
Factory: TRENTON, N. J.—*Stocks in Principal Cities*

CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE

CRESCENT ENDURITE SUPER-AGING INSULATION

WIRING *Methods*

[FROM PAGE 42]

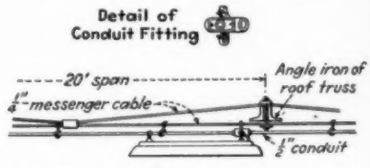
boxes through conduit Tee's and LB's after passing through a disconnect switch. The secondary circuit left the transformers through a like arrangement.

In addition to making a neat job, this method eliminated the need for a supporting rack or frame.

CANTILEVER MESSENGER FIXTURE SUSPENSION

Up in New Haven, Conn., a brewery building was converted for war production purposes. Fluorescent lighting was installed throughout the area and suspended from messenger cable to facilitate proper spacing of the units. The roof truss span was 20 feet and in numerous cases one or more fixtures were spotted between the trusses.

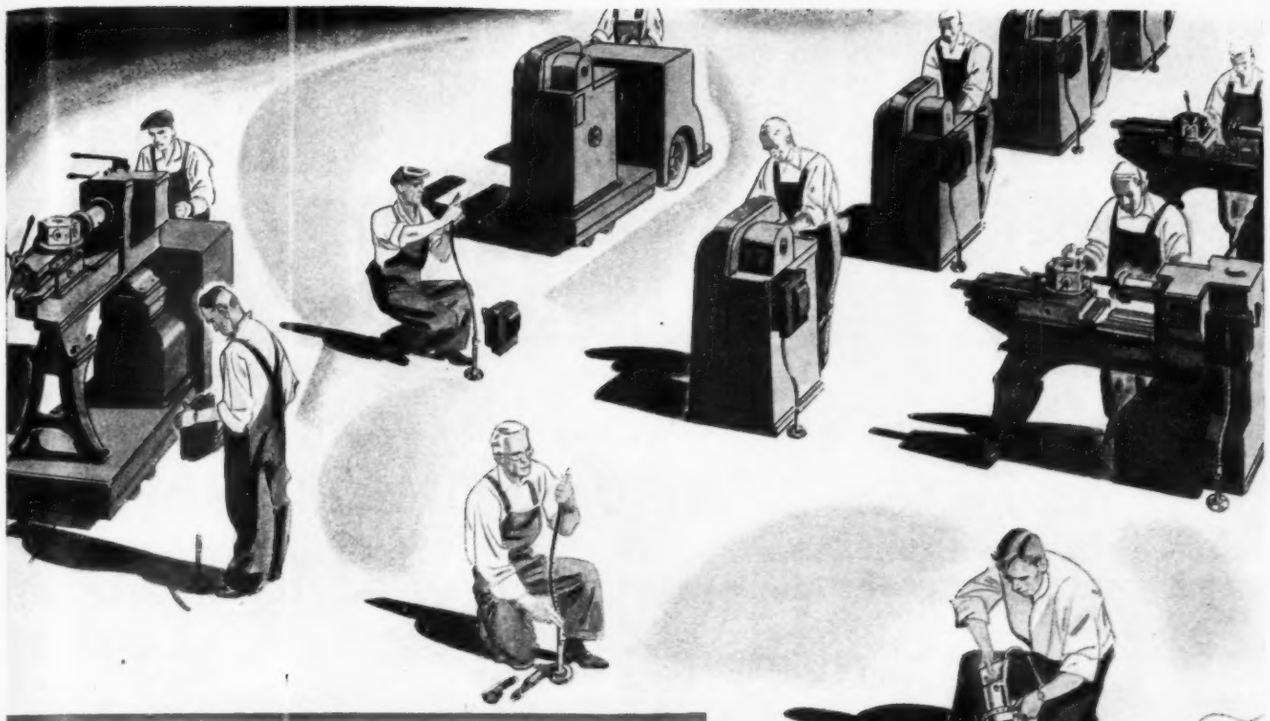
The problem of messenger sag was overcome by the J. S. Nielsen Electric Co., New Haven electrical contractors



***DOUBLE MESSENGER CABLE,** in cantilever arrangement, solved mid-span sag in the rows of fluorescent units in this war plant. The anti-sag cable was looped over bottom truss members and clamped to the supporting messenger at the span mid-point.*

on the job, by employing a cantilever arrangement using a second messenger cable with an anti-sag function. The conduit and fixture messenger were fastened by thru-bolts to the bottom of the double angle iron bases of the trusses. The anti-sag cable was looped over the top of the truss base angles and fastened into place by the thru-bolts holding the fixture messenger. A two-bolt split cable clamp ties the two supporting messengers together at the mid-point of the span. Both messengers were made taut by turn-buckles at ends of the runs before the bolts and clamps were tightened.

The branch circuit conduits were fastened to the messenger cable by special messenger cable clamps and a combination conduit fitting complete with a plug receptacle, messenger cable clamp and fixture hook. The fluorescent units were supported from these conduit fittings and hooks which clamp to the conduit. Fixtures were fed from the plug receptacles in the conduit fittings.



QUICK CONVERSION

from peace to war and vice versa ON Q-FLOORS

G-E Announces

ROBERTSON

Q-FLOOR

ELECTRICAL FITTINGS

For information about these fittings and how they are used to obtain adequate up-to-date electrical wiring—get in touch with your nearest "G-E" Merchandise Distributor.

CONVERSION . . . made smoothly, efficiently, economically, and above all QUICKLY, is the order of the day!

American Industry is cooperating. Its plants are rapidly being converted from peace production to war production.

And wherever Q-Floors have been installed in plant structures or office buildings, conversion is a simple, easy and quick operation. In every square foot of Q-Floors, there are protected wiring raceways...only 6 inches apart...waiting for conversion uses. These large raceways are quickly and easily accessible.

In a matter of minutes, electrical outlets can be installed anywhere they're wanted . . . for machinery and other equipment in the plant, or for telephones, business machines, signals and other services in private and general offices.

Greater profit for the electrical contractor is another Q-Floor advantage. Q-Floors cut down overhead by keeping crews on the job continuously. There is no reduction in productive labor and materials.

H. H. ROBERTSON COMPANY
FARMERS BANK BUILDING • PITTSBURGH, PA.

ROBERTSON Q-FLOORS

WARTIME LIGHTING COSTS REDUCED!

General Electric announces a 12% to 17% reduction in the price of G-E MAZDA FLUORESCENT LAMPS!

Effective September 1, 1942

NEW LOW PRICES ON G-E MAZDA F LAMPS

14-WATT T-12	was	80c	now	70c
15-WATT T-8	was	65c	now	57c
15-WATT T-12	was	80c	now	70c
20-WATT T-12	was	80c	now	70c
30 WATT T-8	was	80c	now	70c
40-WATT T-12	was	$1.15	now	95c
100-WATT T-17	was	$2.60	now	$2.15

Above prices refer to daylight and 3500° white. Prices also reduced on soft white and colored G-E MAZDA F lamps.

Also reduced! G-E MAZDA H (Mercury) LAMPS

400-WATT T-16 AH1	was $11.00	now	$9.50
400-WATT T-16 BH1	was $11.00	now	$9.50
3000-WATT T-9½ AH9	was $45.00	now	$40.00

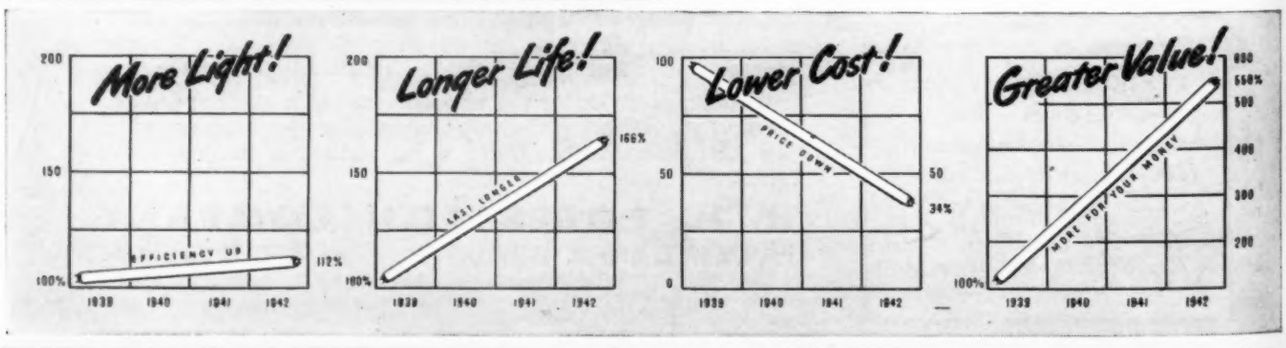
THE SEVENTH REDUCTION IN FOUR YEARS!

NO price reduction, of the many we have been able to make, gave us in General Electric as much genuine satisfaction as this one—made possible at a time when light is being called upon to play a major role in wartime production.

Made in the face of rising cost trends, this reduction is the result of manufacturing economies and technical developments, combined with vastly increased use. It is made in accordance with G-E's policy of passing such savings along to customers.

But lower prices are only half the story. Not only have we been able to reduce prices, we have steadily improved these lamps. They give more light! They last longer! They *stay brighter longer!*

For instance, purchasers of the widely used 40-watt white G-E MAZDA F lamp now pay only 95c instead of the $2.80 they paid in 1939. But we are prouder that this lamp lasts 66% longer and is nearly 12% brighter . . . that it gives you 5½ times more value for your lamp dollar than it did in 1939! (See charts below.)

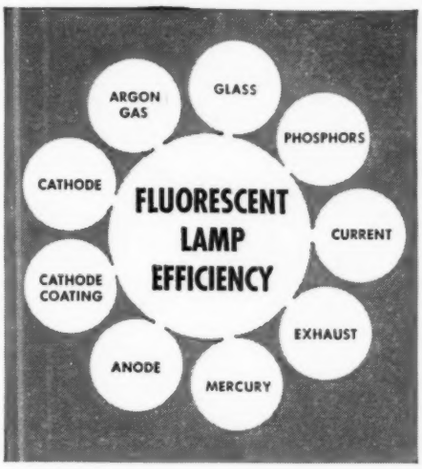


G-E MAZDA LAMPS
MADE TO STAY BRIGHTER LONGER

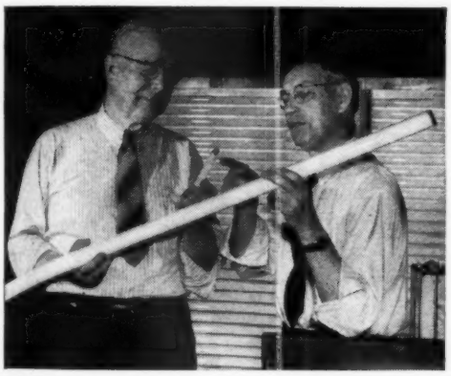
GENERAL

The Story Behind MORE LIGHT *for* LESS COST

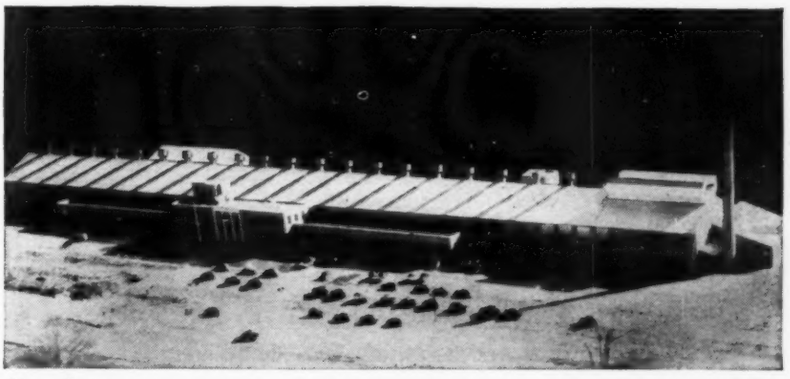
G-E research constantly seeks the best possible combination of all factors affecting lamp efficiency. Here are nine of the most important. There are more than a million possible combinations of these factors. It's the task of G-E research to find the *best* possible combination!



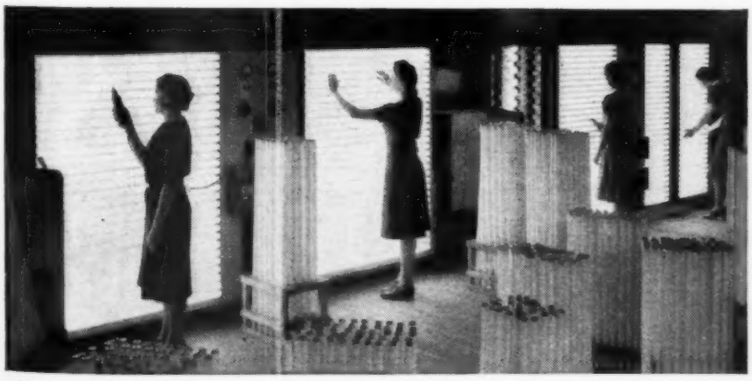
All materials are tested with extreme care. Here, we check the brightness of phosphor powders that coat the inside of fluorescent lamps to make sure that you get maximum performance from your G-E MAZDA F lamps.



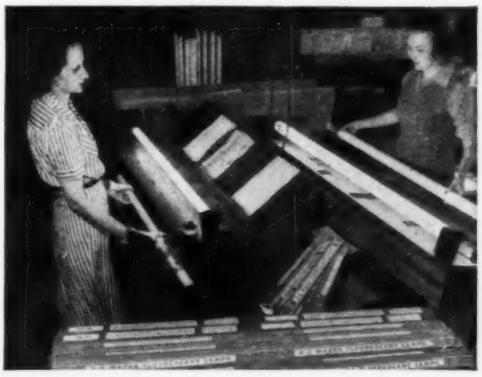
Experience counts. W. L. Enfield (left) and P. J. Pritchard have been active in directing research for better product and lower prices.



Here is one of the new streamlined, specially designed G-E fluorescent lamp factories that have helped materially in reducing costs. Sand for glass tubes comes in at one end. Finished lamps are shipped from the other.



Constant testing guards the quality of G-E MAZDA fluorescent lamps. At every stage in the manufacturing process, General Electric inspections provide safeguards of quality. Above, G-E MAZDA lamps are inspected while undergoing a "seasoning" process on the test racks.



Extra assurance of quality is a series of over 50 tests and checks on completed lamps by MAZDA SERVICE inspectors, who work under the direction of an independent testing laboratory.

GE ELECTRIC MAZDA

Questions ON THE Code

Answered by
F. N. M. SQUIRES
Chief Inspector New York Board of Fire Underwriters

REMODELLING

Q. *"Sometime ago a house was wired for lights using rigid conduit. Recently this house was remodeled making three small rooms out of one previously large room. The new wiring will be in non-metallic sheathed cable. Is it necessary to remove all the old wiring which will not be used from the conduit or will it be O.K to ground the unused wires?"—J.T.F.*

A. The unused wires do not have to be removed nor do they have to be grounded. Either would be permissible but removing the wires is preferable. Care should be taken that no outlet or junction boxes are plastered over or otherwise concealed as this would be a violation. But if the wires are "dead" they do not have to be removed.

SERVICE CABLE

Q. *"In the buildings with service of No. 2 wire or smaller, I have been instructed to use a type S.E. style U unarmored service cable.*

At the service switch this cable is fastened with a connector to the box and between the safety switch box and the panelboard which is in a separate box, is a conduit locked to each box with an ordinary locknut and bushing. The neutral polarity of service, feeder and service switch box are all grounded with a wire run and connected to the water service pipe.

As there is no metal sheath on the service cable, it is impossible to ground it and to my opinion there is no advantage to use a bonding bushing on the service cable connector.

In using locknuts and bushings between the service switch and panelboard, I feel I am complying with Article No. 250, Paragraph 2572a, but the U. S. Engineer claims that the panelboard is part of the service equipment so is recommending the installation of grounding bushing between these points.

Of course, I realize that if the service cable was armored or if conduit was used for the service wire that a bonding bushing would be required for the continuity of ground through the service switch box, but does a standard locknut and bushings on the conduit between the service switch and panelboard meets your requirements?"—C.Y.

A. In this case we are concerned with compliance with Code rules 2571b and c. As the service cable has no armor we are not concerned with 2571a. We must, therefore, see to it that the meter box, the service switch box and the conduit or armor, if any, over the grounding conductor is properly connected in accordance with 2572c and d.

If the neural of the service cable is attached to screws or bolts which are securely connected to the service switch box and meter box, no jumper or grounding bushing is required on the connectors which secure the service cable to these boxes. But if the grounding conductor is run through a conduit or an armor, a bonding bushing or other approved means must be employed there. If, however, the grounding conductor to the water pipe is No. 4 or larger and is bare, and if, of course, connected to the service box and grounded to the neutral service conductor, no further bushing or jumper is required.

After we have complied with Sections 2571 and 2572 at the meter and service switch boxes we need not go beyond them and no grounding jumpers or bonding bushings are required at the distribution panel as this latter is not part of the service equipment. Only when the distribution panel is used as service equipment do we need to be concerned at the panel. Jumpers are not always needed. Sub-paragraph d of 2572 includes "other devices approved for the purpose" and Underwriters' Laboratories' list, besides the "grounding bushings for use with jumpers" some bonding locknuts, bushings, and wedge lugs which can be used without jumpers as these latter are designed so as to make a more positive electrical contact with the boxes or enclosures.

FUSE CLIPS ON SWITCH

Q. *"Why does a motor service switch designed for a three hp., 220 volt, 1 phase motor, only take a 30 amp. cartridge fuse? When this particular switch is installed to control this motor circuit you cannot install a 45 amp. fuse in the clips for branch circuit protection according to the N. E. C.*

"This particular motor has a full load current of 19 amps. According to National Electrical Code, Table 22, page 321, gives a rating at 14 amps."—M.Z.

A. The three hp. switch having fuse clips taking cartridge fuses not larger than 30 amps. was designed to be used under Section 4347 of the National Electrical Code with the expectation that the conditions of maintenance and super-

***KNOXVILLE DELEGATION** includes (L to R) V. Armstrong, contractors; C. R. Wardell, Knoxville Electric Power and Water Board; E. D. Armstrong, State Electrical Inspector, and C. R. Wright, executive committeeman.*

Boy! This saves rubber

NATIONAL ELECTRIC
"DILEC" "FIRE-STOP"

"Rub Less"

ELECTRICAL CONDUCTORS

NO SYNTHETIC—NO RUBBER

NO TINNING

Same dimensions and appearance as regular rubber covered wire

FLAME RESISTANT
MOISTURE RESISTANT
SMOOTH—SLICK—CLEAN

SOLD ONLY WITH UNDERWRITER'S LABEL

Governed by Copper Priority Rules

NATIONAL ELECTRIC PRODUCTS NE WIRES AND CABLES

National Electric Products Corporation
Pittsburgh, Pa.

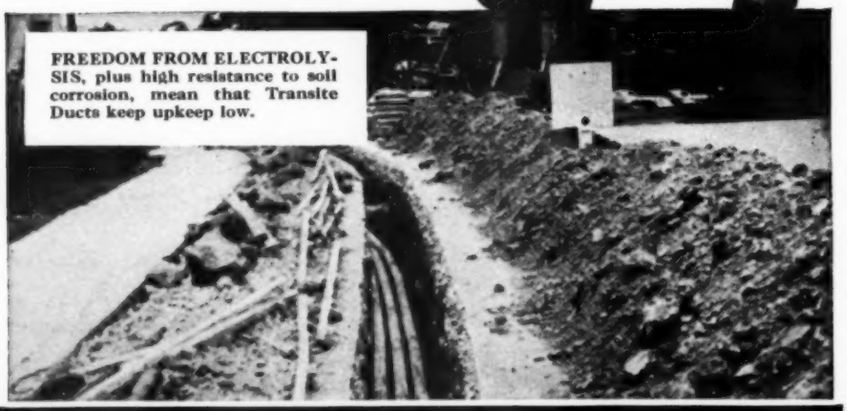
TIME-SAVING FEATURES OF J-M TRANSITE DUCTS--NO.4

EASY HANDLING!

CREWS like to work with Transite Ducts, because these modern cableways are supplied in long, light lengths that make handling easy and rapid. The assembly method is so simple that even unskilled crews can do fast work. No screwing or threading is needed. Lining up is fast and accurate.

And, on the job, these asbestos-cement ducts won't rot, can't burn, effectively resist corrosion, help assure permanently low maintenance costs.

For details, write for brochure DS-410. Johns-Manville, 22 East 40th Street, New York, N. Y.



FREEDOM FROM ELECTROLYSIS, plus high resistance to soil corrosion, mean that Transite Ducts keep upkeep low.

Johns-Manville

TRANSITE DUCTS

TRANSITE CONDUIT . . . for exposed work and for installation underground without concrete encasement.

TRANSITE KORDUCT . . . for installation in concrete. Thinner-walled, lower-priced, otherwise identical with Transite Conduit.

Questions on the Code

[FROM PAGE 48]

vision will insure the use of "appropriate fuses" for the protection of the motor.

In the case of the average three hp. single phase 220 volt motor under proper supervision 20 amp. time lag fuses would be the "appropriate fuses" referred to in Section 4747, and the motor circuit could be No. 12 wire.

But with a motor with a running current of 19 amps. the "appropriate" time lag fuses would be rated at 25 amps. and the motor circuit should be not smaller than No. 10 wire.

Of course the ampere ratings given in Tables 21, 22, 23 and 24, are average rating only. See footnotes marked with a dagger following these tables.

A LIGHTING DEMAND PROBLEM

Q. *"We are engineering an electrical installation for a new proposed library building. In one section of this building there are six book stack floors with approximately 200-25 watt lamps on each floor located between book stacks with a demand factor that would not exceed 50 per cent or approximately 2500 watts per floor. If these outlets are circuited in accordance with Code of 10 outlets per circuit, each circuit would not exceed 125 watts.*

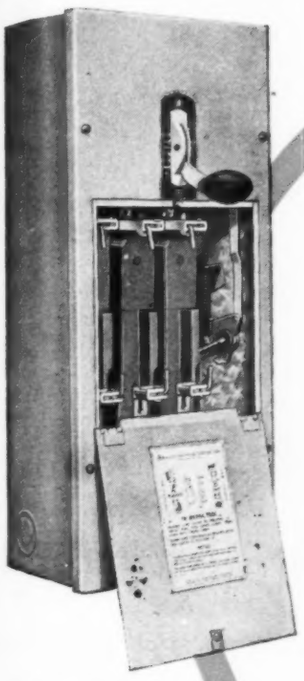
"On similar jobs in this jurisdiction the inspection department have given us special permission to increase the number of outlets on each circuit inasmuch as the load of each socket is well established.

"Will you please advise us the maximum number of sockets you would permit on one circuit for this particular part of the installation?"—M.C.

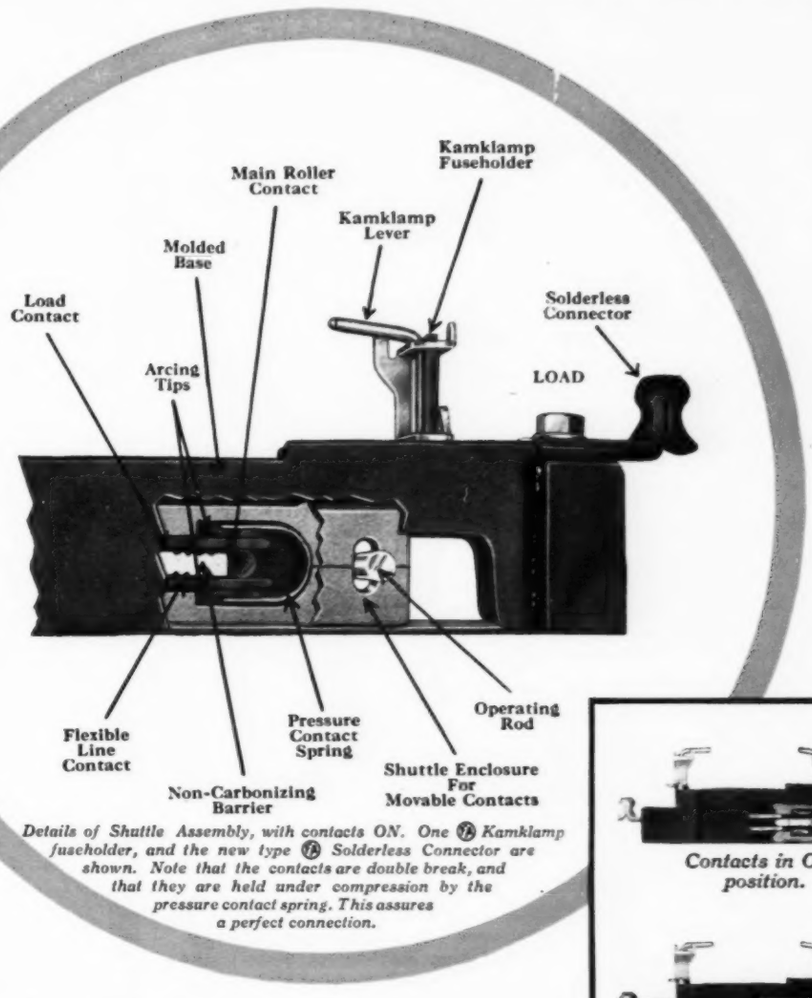
A. The rules in Article 210 of the National Electrical Code are based on the fact that it is impossible to always tell in advance and for any appreciable length of time what the actual amount of current to be used will be, but that experience has shown that in some occupancies such as dwellings, stores, offices, etc., the amount of current used is proportional to the area involved. This has brought about the "watts per square foot" rules.

However there are some occupancies where the demand at any time within the area involved is very low and yet a large number of available light sources are desired. Manual switchboards and switching rooms in telephone exchanges as mentioned in paragraph 2108e2 of the

A Revolution in Safety Switch Design!



100 Amp., 575 Volt Ⓕⓐ SHUTLBRAK Switch, Cat. No. SA-10633.



Details of Shuttle Assembly, with contacts ON. One Ⓕⓐ Kamklamp fuseholder, and the new type Ⓕⓐ Solderless Connector are shown. Note that the contacts are double break, and that they are held under compression by the pressure contact spring. This assures a perfect connection.

Contacts in OFF position.

Contacts in MAKE or BREAK position.

The contacts are shuttled ON and OFF—

that's why it's called the

Ⓕⓐ SHUTLBRAK SWITCH

For motor circuits, service entrance, or any installation requiring an operating switch, this heavy duty industrial switch has new advantages.

The roller type main contact and auxiliary contacts are enclosed in an insulated shuttle. This shuttle assembly in turn is entirely surrounded by insulating material. There is an arc resisting barrier at all times between the line and load contacts — and contacts are held under compression in ON position. Silver plated current carrying parts insure low resistance. Properly engineered springs assure quick make and quick break. It is equipped with Ⓕⓐ Kamklamp (pressure type) fuseholders for either ferrule or knife-blade types of fuse terminals, and with the new Ⓕⓐ Solderless Type Pressure Connectors.

As an additional safety factor, Type A is equipped with an interlocking arrangement between the switch operating lever and the door of the fuse compartment. The door cannot be opened when the handle is in the ON position. (Type B does not have this interlocking feature.)

Enclosures have ample wiring space at top, and AT REAR of the switching mechanism. Attractively finished in pearl gray enamel.

Front operated, the Ⓕⓐ Shutlbrak Switch may be used singly, banked in groups, or assembled in compact, well designed switchboards and panelboards.

Capacities: 30 to 1200 amp., inclusive, for 250 volts AC or DC, and 30 to 600 amp., 575 volts AC, in 2, 3 and 4 poles. Approved by Underwriters' Laboratories.

For detailed information, and suggested specifications for Shutlbrak Switches, Panelboards and Switchboards, write for Bulletin No. 59 . . . Frank Adam Electric Company, St. Louis, Mo.

1ST. THE SIGN OF A Ⓕⓐ 1ST. BETTER JOB

Frank Adam

ELECTRICAL PRODUCTS

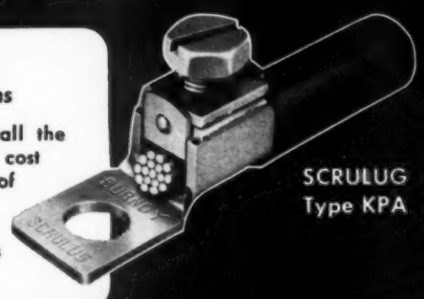
for Defense Industry

FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.

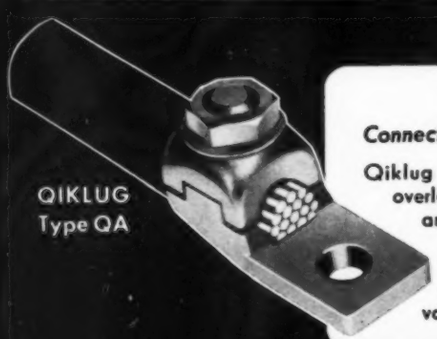
HIGHER INSTALLATION COSTS
DEMAND GREATER PRODUCTIVITY —
GET MORE CONNECTIONS PER HOUR
WITH
BURNDY
LUGS

SCRULUG, Type KPA
Low Cost Indoor Installations

Screw driver, pliers or wrench install the Scrulug, in matter of seconds. Low cost — high conductivity. Takes range of cable sizes. Try the Scrulug where space is limited — on panel boards and terminal blocks, in fuse boxes and safety switches.



SCRULUG
Type KPA

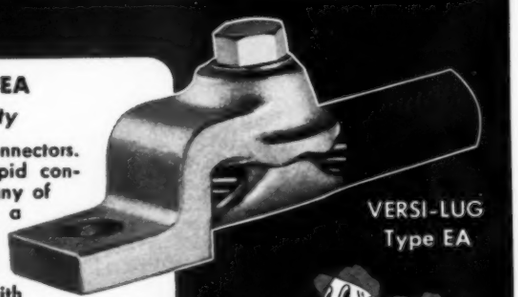

QIKLUG
Type QA

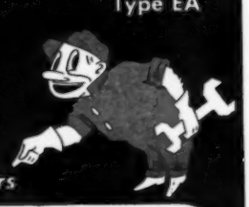
QIKLUG, Type QA
Connections with the Turn of a Wrench

Qiklug connections stay tight, despite overloads, large temperature variations, and high mechanical stresses. The connector is made of high strength alloys, with good conductivity and corrosion resistance. Can be salvaged and used over and over again.

VERSI-LUG, Type EA
Speed Plus Versatility

A new idea in electrical connectors. The swivel design permits rapid connection of the conductor at any of five different angles — with a range of cable sizes. High mechanical strength, high conductivity and corrosion resistance. Quickly installed with an ordinary wrench.


VERSI-LUG
Type EA



See Your Wholesaler About Burndy Connectors

BURNDY ENGINEERING CO., Inc.
459 EAST 133rd STREET • NEW YORK, N. Y.

Questions on the Code

[FROM PAGE 50]

Code are recognized as such. And a bookstack room in a library would undoubtedly be another.

An inspection department would, therefore, be justified in using its own judgment on such an installation and would be justified in permitting a 50 per cent demand load of 15 amperes to be placed on a 15 ampere branch circuit. This circuit could therefore have a total connected load on it of 30 amperes but the inspection department could insure against overloading by requiring the use of a 15 ampere Type S fuse. Assuming that a 25 watt lamp uses approximately ¼ amp. this would permit the use of 120 of the lamps to be connected to a circuit.

OFFICIAL INTERPRETATIONS

by the

Electrical Committee of the N.F.P.A.

Interpretation No. 229

STATEMENT . . . Requests had been received from several sources asking the Emergency Committee to give consideration to the recognition of fluorescent lamp fixtures where the voltage exceeds the 150 volts to ground limit specified by the first sentence of section 2105 of the 1940 National Electrical Code. The statement was made that in conserving copper, higher voltages were being used; that it was desirable to supply fluorescent lamps from these higher voltage circuits; and that fixtures and accessories were on the market suitable for the voltages available. After deliberation, the following was adopted as the sense of the Emergency Committee.

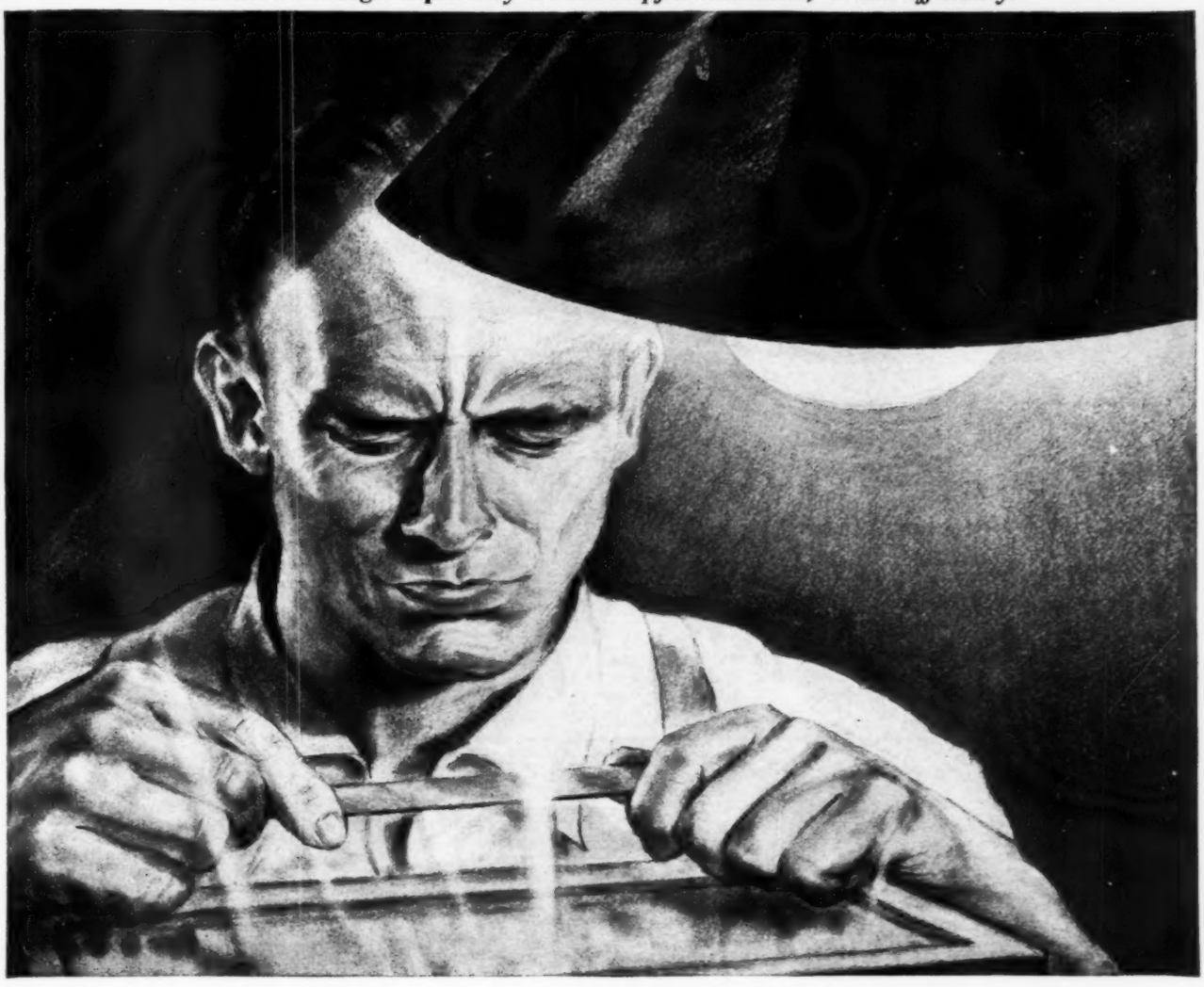
ANSWER . . . It was not the intent of the Electrical Committee that the expression "shall not exceed 150 volts to ground," which appears in the fourth line of section 2105 of the 1940 National Electrical Code, should be interpreted as applying to circuits supplying lighting only in industrial establishments where the fixtures are not less than 8 feet from the floor and do not have individual switch control.

Interpretation No. 230

STATEMENT . . . A demand has arisen for the use of a fuse located in or on the fixture itself in addition to the required over-current protection of the circuit.

ANSWER . . . The requirement of paragraph a of section 2435 of the 1940 National Electrical Code that overcurrent devices be "readily accessible" does not apply when the overcurrent device is in addition to that required for overcurrent protection.

A MILLER Message inspired by WPB's helpful handbook, "Plant Efficiency."



How to save Industry from "SQUINTING SAMS"

You can help workers see clearly and sharply . . . at all times, on all jobs. Show war plants how essential adequate lighting is for fast, precision production. Give them real working *daylight* from a MILLER *Continuous Wireway* Fluorescent Lighting System.

WPB says better lighting brings these benefits . . . "1– Increased production; 2– Better workmanship; 3– Continued production by older employees; 4– Less eyestrain; 5– Reduction in accidents; 6– Better morale; 7– Better housekeeping."

In war plants from coast to coast the MILLER *Continuous Wireway* Fluorescent Lighting System is now delivering such benefits.

MILLER 50 FOOT CANDLER or 100 FOOT CANDLER will provide industry with fine, man-made *daylight* . . . adequate, productive illumination evenly distributed over every working surface. MILLER TROFFERS will duplicate that performance in plant offices and drafting rooms.

MILLER, by virtue of almost 100 years of lighting experience, working with all types of light sources . . . filament, mercury vapor and fluorescent . . . can give you exactly the lighting equipment you would like to specify for today's crucial needs, engineered to the "seeing" tasks of your customers' businesses, and constructed to effect savings in critical materials in line with WPB requirements.

A MILLER field engineer (located near you) is available to assist you in the planning of the most efficient lighting layout for each of your jobs and in every other way possible. For prompt action, write or wire us today.

BUY U. S. WAR BONDS

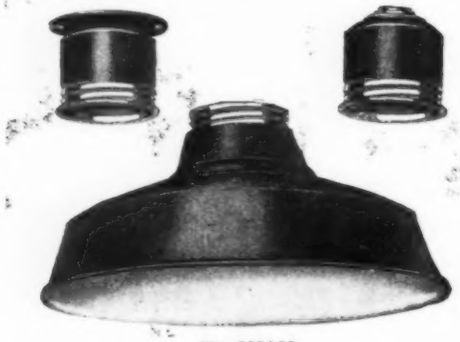
MILLER

50 FOOT CANDLER
100 FOOT CANDLER
MILLER TROFFERS
Continuous Wireway Fluorescent Lighting Systems

THE MILLER COMPANY
MERIDEN, CONN.
Pioneers in Good Lighting Since 1844

● MILLER offers a complete line of filament and fluorescent lighting equipment.

QUAD
LIGHTING UNITS
with the RLM Label • • •
JUST RIGHT Now
FOR THOSE COMPLICATED
DEFENSE LIGHTING JOBS



No. 1184-M
RLM THREADED
DOME REFLECTOR

ADJUSTABLE PORCELAIN
ENAMELED FLOODLIGHT

THE RLM Label on QUAD Lighting Units means that they fill all high intensity requirements to speed defense production. Defense work has opened up the need for many additional installations of lighting equipment so that it is becoming really big business. QUAD Units will fill the bill in every case. Basic design and construction features are correct—they are modern in every respect—they give no after installation worries. QUAD is the line that will be as popular tomorrow as it is today.

•

QUADRANGLE MFG. COMPANY
Mfgrs. of Incandescent and Fluorescent Lighting Equipment
32 SO. PEORIA ST. CHICAGO, ILL.

Industrial Photoelectric Applications

[FROM PAGE 23]

nected to a dog or stop which may be placed behind the lever or pedal which engages the clutch so that the lever cannot be moved. This scheme is illustrated in figure 2.

Another scheme for controlling presses operated by a lever or foot pedal involves removing the foot pedal or lever and substituting a solenoid to engage the clutch. When this scheme is employed, a foot operating push button station is required.

If the press is operated by a magnetic clutch the relay contacts in the photoelectric equipment can be used in series with the existing push button station. This arrangement assures that the magnetic clutch cannot be energized unless the push button is depressed and the relay contacts of the photoelectric equipment are closed. If these contacts are closed, it means the operator's body is not interrupting the light beam and is, therefore, in a safe position.

One of the most common applications of the "electric eye" is its use as an initiating switch for an electrically operated counter.

Typical of the industrial counting jobs being done by photoelectric equipment is the counting of objects or material on a conveyor system or production line. Photoelectrically operated counters are particularly useful in applications where high speed of operation is essential. Counts as high as 800 per minute are being made successfully. A typical counter installation diagram for a conveyor is shown in figure 4.

Photoelectric equipment has proven to be very useful as limit switches in numerous industrial operations. A few of these applications are:

1. To prevent material from being run off a conveyor onto the floor or to stop the material at predetermined positions along an assembly line.

2. To limit the lateral motion of web-like material such as paper or rubber while in process.

3. To maintain the loops in paper or other web-like material while in process.

When applied as a limit switch the photoelectric equipment usually operates in the control circuit of the driving motor. A block diagram of typical limit switch application is shown in figure 3.

While the above applications are typical, they are by no means the only applications of photoelectric control in industry. The list is increasing daily and the end is still not in sight.

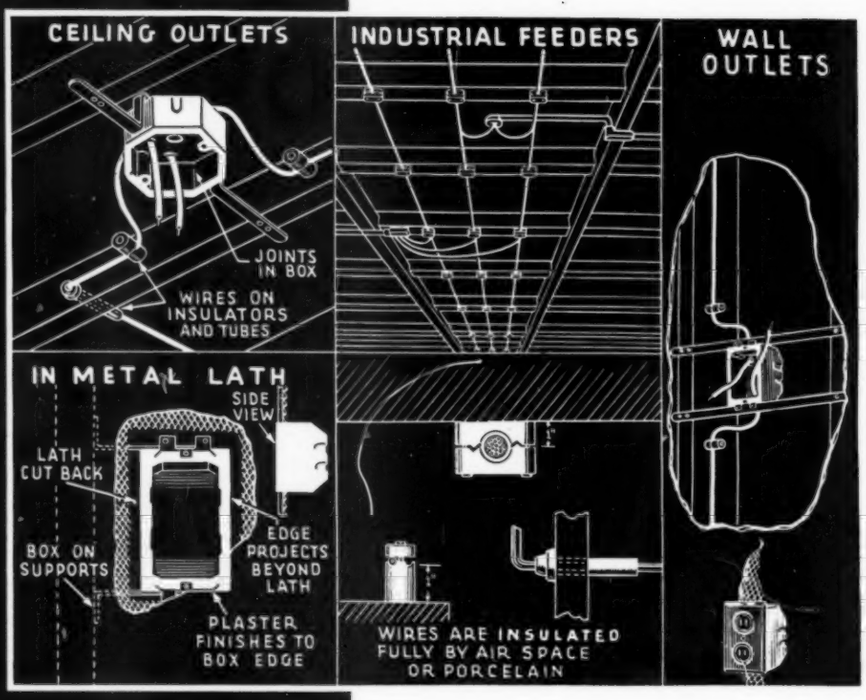
SHUR-LAG

For half a century, through peace and war, good times and bad, the Chase-Shawmut Company has devoted itself exclusively to the design and manufacture of electrical protective devices. There are fifty years of highly specialized experience in Shawmut Shur-Lag Renewable fuses; and if you want to appreciate what that means, compare a Shur-Lag with any other renewable fuse for workmanship, performance, or ultimate cost. Shawmut builds for protection, not for price; so you cannot buy a better value than a Shur-Lag fuse. Ask your dealer, or write for our Bulletin 400.

The Chase-Shawmut Company
Newburyport, Massachusetts
Fuse Makers Since 1893

ONE OF THE
LINE

Easy to install



IMPORTANT FACTS CONCERNING TODAY'S WIRING

Porcelain offers a wiring method that will conserve the greatest amount of critical materials while preserving established principles of safety and durability. It is the logical system to specify and use on every job possible, not only to conserve vital metals for defense but to assure a better wiring system for customers after we achieve victory.

•

Modern PORCELAIN PROTECTED WIRING SYSTEMS take Standard Wiring Devices and Fixtures

★

Porcelain junction and fixture outlet boxes can be mounted with box hangers or attached to wood supports. They provide a flush installed mount and are convenient as plaster support, the plaster adheres to the porcelain and makes a tight seal. All types of covers for these boxes are available.

Switch and outlet boxes of porcelain are designed in accordance with the standards of practice to which the contractor is accustomed. They may be supported to the side of the studding, with Kruse mounting strips, or flush with plaster or composition walls.

The spacing of conductors, to amply keep them separated and to dissipate any heat from loaded wires, the mounting of the wires on porcelain supports, and the insulating of wires from wood members by means of porcelain tubes, all follow the same wise principle which the early code writers held to be paramount in any wiring systems—namely, that all wiring should be so constructed as though the wires were bare.

In view of all this, Modern Porcelain Protected Wiring is without a peer as a MAXIMUM STANDARD of wiring because it provides both maximum current carrying capacity and maximum INSULATION.

MODERN PORCELAIN PROTECTED WIRING SYSTEMS

★ ILLINOIS ELECTRIC PORCELAIN CO.
Macomb, Ill.

★ KNOX PORCELAIN CORPORATION
Knoxville, Tennessee

★ PORCELAIN PRODUCTS, INCORPORATE
Findlay, Ohio

Industrial Electrification

ENGINEERING · INSTALLATION · MAINTENANCE

LOAD ECONOMY

THE tremendous new war production demands on electrical generating and distribution capacity will become increasingly apparent as we enter the fall and winter months of this year. Rising normal demand peaks will be aggravated by new industrial loads from plants just beginning to reach full production.

The result will be rationing of electricity in some areas, principally in the form of peak limiting regulations, staggering of operating schedules and curtailment of some civilian uses. The new rules are already in shape and they can be applied quickly to any area where power shortage appears.

Now is the time to get set, however, for whatever limitations may be necessary in your area. And it is always good business and management to make the most economical use of power. Control of peak demand is an important factor in power cost control in peacetime. It becomes more important than ever under wartime conditions. Usually it needs skillful planning in plant operation. Invariably it requires careful attention to the types of electrical equipment used and the methods of control.

Previous articles covered—

Eliminating Causes of Severe Service Conditions
Providing Adequate Capacity for Increased Demand
Electrifying Operations to Reduce Unit Costs
Safety Protection for Electrical Operations
Increasing Flexibility of Electrical Service
Electrical Aids to Automatic Control
Electrical Ways to Reduce Waste
How to Save Power
Protection Against Sabotage
Improving Working Conditions
Electrifying for Continuous Operation
Electrified Plant Housekeeping
Electrical Problems Under 168 Hour Schedules
Electrical Aids to Plant Conversion
Electrical Aids to Qualtiy Control
Electrical Aids for Green Help
Codes in Wartime
Grounding for Safety
Limiting Power Demand (this issue)

Future articles will discuss—

Preparing for Blackout Operations
Welding in Industry
Operating with Minimum Electrical Replacements
Restoring Electrical Service
Wiring for Quick Changes
Salvaging Electrical Equipment

LIMITING POWER DEMAND

THE recent power limitation order, L-94, issued by the War Production Board should focus the attention of every plant electrical man and every factory manager upon the necessity of operating his plant with the lowest possible power demand. Because this order includes the possibility of running private plants in conjunction with the utilities, the plant making its own power is equally concerned with the plant buying all of its energy.

In any area where a shortage of power is later declared to exist, energy use and demand must be limited to quotas established for each plant. These may be lower than normal use. Certain types of non-essential load will be ordered discontinued. Examples are: (1) refrigeration for air conditioning except where essential for industrial processes, (2) interior or exterior sign lighting, (3) interior or exterior outline and ornamental lighting, (4) interior or exterior lighting for decorative or advertising purposes, (5) outdoor and floodlighting except for defense property protection required by war regulations. Industrial generating plants now idle may be required to run, ones having excess or reserve capacity may be ordered to tie into the utility system for parallel operation.

While war production plants are exempted on paper, any real power shortage in an area might force them to be included, at least to follow good practice as an example to other less favored companies. Every plant should be ready and this is the time to prepare.

The purpose of L-94 is to maintain war production at its maximum level but with as little interference as possible in essential or accustomed "civilian" activities.

Because staggering of industrial load will release considerable utility generating capacity, properly designated authorities may be expected to regulate the times when industrial plants may run. Those plants operating less than 24 hours daily may be called upon to stagger their off hours, or to be shut down during the hours of the daily system peak on the utility system. Those factories working less than seven days weekly may be directed to rotate their days off so that what are Mondays or Thursdays for some will be Saturdays or Sundays for others.

It isn't here yet, but it is in the cards, and it is good business anyway to make the most economical use of power.

Individual Plants Can Do Much

Broad controls can be made effective by authority, but major reductions in power demand and power use can be accomplished in the plant itself, if ini-

INTERLOCKING of motors can prevent short peaks and blown fuses. Motor in foreground drives conveyor extending into background, and is interlocked with drive for transverse feeding system, visible in background. If any drives in entire system stops, all drives feeding that section are stopped also. (Westinghouse photo.)

tiative and study are employed by management and the electrical men in charge. Elimination of short power peaks and waste may help war productive capacity as much as outside regulations serve to reduce overall system peaks on the utilities which supply the plant.

Direct savings in the power bill and in utility capacity are only part of the gains for the industrial plant. Improved load-factor increases the effective capacity of the entire wiring system. Cutting demands means reducing the amperes to be conducted, thus releasing that much more productive capacity. Improving the load-factor, by reducing demands, increases the effective capacity of transformers and generators, for with reduced load there is less heating and a smaller drop in voltage through these units. Likewise, the line and equipment losses due to current will be reduced if load-factor is improved through controlled demands.

Any improvement in load-factor must start with a study of the load curve of the plant. If no recording demand meter records are kept by management, the demand charts of the power company may be examined. Any plant not having a continuous uniform process will ordinarily discover that there are periodic short term demands which may be almost anything above the normal or average demands. Ordinarily it will not be difficult to discover the factory unit causing this short demand. Its elimination will then be determined by the conditions existing in that particular operation. There will be many cases, however, where the time of the demand varies, and where it is caused at different times by different units. In such cases, it may be necessary to set up a log of machine operations to discover which units are running at the time of the peak.

Machine Operating Log

Some plants maintain logs of the operations of their different machines, but it does not appear to be a general practice. Meters may be installed to show the number of running hours, or graphic demand meters may be installed. For the purpose of this study, the period covered during the test need not be very long to determine the effect of the particular unit on the overall picture, yet must be long enough to give at least the normal operating hours and cycle. Such a log and demand study will show the relation of individual operations to the production schedule of the plant.

Naturally, controlling the demand of an individual production unit will depend upon its position in the productive cycle. If its schedule can be changed without interfering with production, the solution is simple. If, as is frequently the case, the unit must run at a certain time in the cycle, it may be electrically interlocked with some other unit which can be stopped during that period. Each case will be solved in a different way, but the problem should be studied and a solution ready when necessity or desirability calls for its adoption.

Spot Welders, Test Connections, etc.

Some demands, such as those from spot-welders, test units, and so forth, are of such short duration that they are not recorded on ordinary demand meters yet seriously limit the ability of the distribution system to supply other loads. These are serious because they

CAPACITORS improve power factor for the entire electrical system. These four 15-kva. capacitors connected directly to the feeder circuit are similar to installations at load centers throughout the plant which keep power factor at 95 per cent. Electrical losses in the line have dropped considerably.

cause voltage dips which are detrimental to lighting and other power applications. They often cause such voltage dip at the time of the weld that inferior welding results. Correction of this condition may be required if the welder is to continue in use. Most satisfactory relief may be had through the use of a motor-generator set. The custom is to supply a large single phase generator driven by a relatively small polyphase motor. Since the set runs most of the time with no electrical load, the small motor maintains the normal operating speed. When the weld is struck, the inertia of the large generator maintains correct voltage during the period of the weld. The motor easily picks up the small drop in speed during the weld. Fortunately the duty cycle of a spot welder is so short that one M-G set can supply current for a number of welders.

Capacitors have been used with welders to offset the low-power factor of the welder. This, however, will not spread the load out as much as will the motor-generator set.

Demand Limiters

Simple and quite effective demand limiters can be made using current transformers and relays to drop predetermined load as the demand reaches certain magnitudes. Controls such as this can be designed to work in steps, dropping load increments as the demands recurrently approach set maximums. Loads to be dropped are those which will have little or no effect upon production such as pumps discharging into reservoirs, air compressors with large receivers, heating units in noncritical operations, ordinary circulating fans, or even noncritical portions of plant lighting. All such controls can be designed to restore normal operation when the plant peak load shall have dropped enough to permit their use. Time delay should be included on all such relays so that momentary surges or dips will not cause relay action. Wiring to be added for these purposes is very small size, for control circuits only are needed. Use of such a control system on heavily loaded main or branch fuses or breakers will prevent dropping the total load on the breaker in the event of a short term overload.

Units requiring a large amount of power and operating on irregular schedules can be quite simply interlocked electrically so that two or more such units will not run simultaneously. Interlocking two or more welders so that only one weld will strike at a time is already a somewhat standard arrangement.

Controlling Long Hour Loads

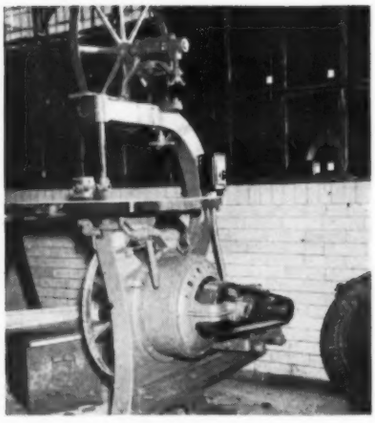
There is another group of power users which frequently set up demands greater than are needed because of improper engineering or subsequent changes in operating conditions. Only the plant force will know which are present, but a few instances may be described here.

Water is usually pumped into a tank for storage. Frequently the controls are such that a small variation in level will cause the pump to operate. Controls may be reset to permit a longer off period, thus reducing short term peaks. In many cases the pump is larger than needed and refills the tank in shorter than necessary times. A smaller pump, or a slow down in pumping speed will reduce power demands. If water storage is restricted, a supplementary tank might be erected to allow a lower pumping rate over a longer period of time.

MAINTENANCE GUIDE SHEET... *REDUCE DEMANDS—CONSERVE ELECTRICAL CAPACITY*

	WHY	WHAT	WHERE
SCHEDULING	Lower utility peak demands Take advantage of off-peak rates	Reschedule work hours	Total plant (May be ordered)
	Reduce plant peaks Conserve capacity of electrical system Improve load factor Increase use on off-peak rates Save on demand charges	Reschedule work hours	Departmental
	Reduce plant peaks Relieve overloaded circuits Reduce line losses Improve load factor Make capacity available for new load Earn lower rate	Reschedule work periods	Individual machines
	Prevent short peaks Prevent blown fuses Maintain better voltage Release system capacity	Interlock electrical units	Individual machines or other units
ELECTRICAL LOSSES	Reduce line losses Prevent blown fuses Release line and transformer capacity	Improve power factor by better motor application, capacitors, or synchronous motors Remove high-resistance grounds and short-circuits Prevent local heating by good contacts on fuse clips, switches, and connections Reinforce overloaded circuits by increased number and better located load-centers Segregate important loads Relocate feed point on circuits carrying distributed loads	Total electrical system
	Raise operating efficiency Improve power factor Reduce line losses Save investment Use smaller motors Maintain better voltage conditions Prevent momentary voltage dips	Remotor to correct size for load by reassigning motors now on lines	Underloaded motors
		Rely on motor overload capacity for short power swings	Cyclic operations
		Increase fly-wheel effect and correct counterweight position	Pulsating loads
		Use magnetic or fluid clutches M-G Set. Use inertia of large generator driven by small motor to supply sudden short loads	Heavy starting loads A. C. spot welders test connections

	WHY	WHAT	WHERE
MECHANICAL LOSSES	Eliminate shaft friction	Divide into larger number of smaller groups Drive special purpose machines individually Separate motors for isolated groups—eliminate multiple jack-shafts and long belts	Large group drives
	Reduce idler friction Improve belt operation Increase belt life Save floor space	Use floating motor base	Short-center drives
	Reduce power Increase output Save investment	Pump at head required for bulk use Use smaller boosters where needed for higher pressures Larger storage for longer hour pumping and control for off-peak use Use widest practical range of storage level for pump control for fewer starts Use multiple pumping units and supply at minimum quantity to reduce friction head Eliminate all possible pipe and sharp bends	Water pumps
	Reduce power Control demand	Produce at pressure least practicable above that of utilization Increase volume of receivers for longer hours pumping and off-peak control Prevent waste through built up heat loss by after-coolers and multi-stage compressors Eliminate air leaks Spring valves for instant to prevent waste closing	Air compressors and air systems
	Reduce power load Save investment	Reduce friction pressure Use minimum volume of air for task Keep velocity at minimum required Use variable speed motor if air requirements vary, and run at lowest practicable speed	Fans
PRODUCTION	Save waste time and material	Make seeing easier to prevent mistakes, faster reaction time, and less fatigue	Improve lighting and painting
	Speed production	New methods which reduce unit production time and so increase production or permit fewer hours with no loss in production	Infra-red heating Induction heating Higher speed tools Electric trucks Conveyors



FLY-WHEEL EFFECT *on pulsating loads helps maintain better voltage conditions. The old d.c. motor that used to drive this band saw was stripped of its copper and belted to the new a.c. motor to act as a speed stabilizing fly-wheel.*

It may be that water pressures needed in certain uses are much higher than are needed for the general plant supply. Lowering the pressures to those needed for the general supply, with local booster pumps for the small quantity of high pressure water will reduce the power demands and energy used.

Compressed air needs are often supplied at pressures much higher than those needed for the assigned tasks. Needed pressure should be investigated, and furnished at a pressure only enough higher to compensate for losses. Using small receivers for storage at high pressure may save steel in the receiver, but it requires unnecessary power to produce that pressure. If only one large compressor is used to supply air, power demands may be kept more uniform if two are used, one to run continuously, and the other to cut in and out as air needs vary.

Ventilating systems may be moving air at volumes much in excess of those needed for satisfactory operation. Since power requirements vary as the cube, a reduction in air movement and volume where possible will reduce power demands considerably. This also applies to exhaust systems and dust collectors. Be careful not to reduce the air volume below that required for the particular task.

Friction Losses

Mechanical power transmission systems, particularly in older plants, frequently waste much power. Shafts misaligned, bearings worn, belts too tight, angle drives, excessive number of jacks, shafts, belts too long and too loose all take power without producing anything. These losses are usually considered to be fixed, but actually they increase as active load grows, for increased load adds to belt tension which in turn further distorts the shafts and increases the friction in the bearings. The active electrical man will find quite often that motors in stock can be used to drive portions of large transmission groups, and so make smaller more efficient drives out of larger inefficient ones.

Idlers to maintain belt tensions often require a large part of the capacity of a given drive. Shorter centered drives, using tension motor bases, will save power and extend belt life in addition to taking up less floor space.

Correct Motor Size

Although the previous items mentioned save power demands mainly through savings in mechanical losses, there is also much to be gained in the electrical system, principally through correct motor application. Common practice is to use the next size larger motor on a given load to insure ample power for the drive. Motor efficiency drops rapidly when load drops from eighty or ninety per cent of rating to fifty or sixty per cent. At the same time, the power factor also drops very low. This practice keeps the motor cool, but a cool motor is normally an inefficient motor. Designed ratings are generally for a temperature rise of 55 degrees Centigrade, almost one hundred degrees Fahrenheit, above room temperature. This is too hot for most persons hands.

It should be possible in most plants to check the actual loads on motors, and replace all underloaded ones with units more nearly the size. Motors have a large overload capacity, hence this factor should be used to carry power swings of short duration. This alone might reduce demands of motor power by as much as five or ten per cent.

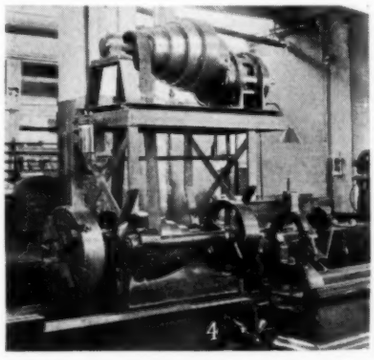
Underloading motors is the main cause of low plant power factor. Since low power factor increases the current without adding to the work output, it puts larger loads on all plant wiring, switches, transformers or generators. Line losses from overheating due to low power factor may be very great, particularly if lower voltages are used for power distribution. This is a vicious cycle, for line loss reduces voltage at the motor, which in turn requires more current to do a given amount of work. Use of the smallest motor to carry a specified load is the best way to improve power factor for it requires no additional equipment and also improves motor operating efficiency.

If, after remotoring, poor power factor still exists causing excessive line loss, capacitors may be added. For best results, the power factor of different circuits should be known and the proper sized units added to each circuit for the correction needed on that circuit. The capacitors should be placed close to the offending unit or near the end of the circuit, located after transformers they increase transformer capacity and help the power company; located at the ends of the circuits they also increase line capacity, transformer capacity and help the Power Company.

Troubles on the wiring system may increase power demands through direct waste. High resistance grounds and short circuits may cause "leakage" which registers on the meter without blowing fuses. Bad connections and poor contacts on switches and fuses may cause local heating with consequent operating troubles and waste of power. These items seem obvious, but wiring must be checked frequently if the system is to be kept free of such losses.

No discussion on reducing power demands would be complete without commenting that increases in the uses of power in many instances may reduce total requirements. Improved lighting may speed work and lower rejects to such an extent that the power requirements per unit of delivered product are much less. Infra-red heating may speed production enough to stop operations at critical times without decreasing the total output. Higher speed tools requiring more power may also raise plant output enough to permit power reductions elsewhere or to shut down during critical hours.

Ordinarily the cost of power is such a small part of the total operating cost of the plant that management has relatively little interest in minor savings. Because of outside pressure today, the electrical man will be able to get a hearing on many improvements which not only save power, but which result in much higher plant efficiency. This is another opportunity for the electrical man to demonstrate that his end of the business directly affects plant efficiency.



SPECIAL PURPOSE *machines, individually driven, eliminate shaft friction. This 22-in. engine lathe is driven by a gear motor, the belting was salvaged from the overhead line shafting for the short drive retained.* (*Westinghouse photo.*)

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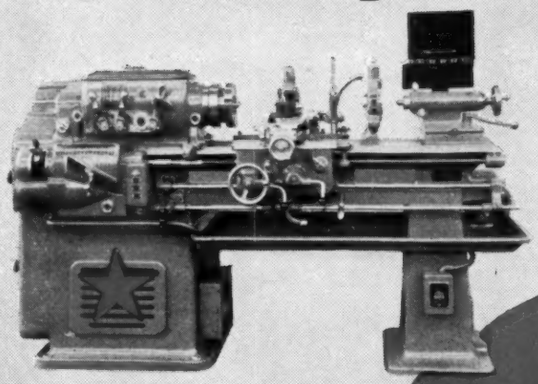

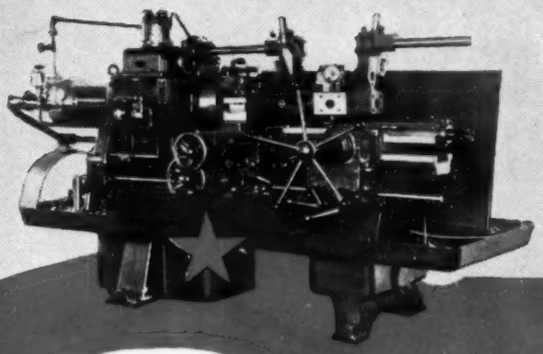

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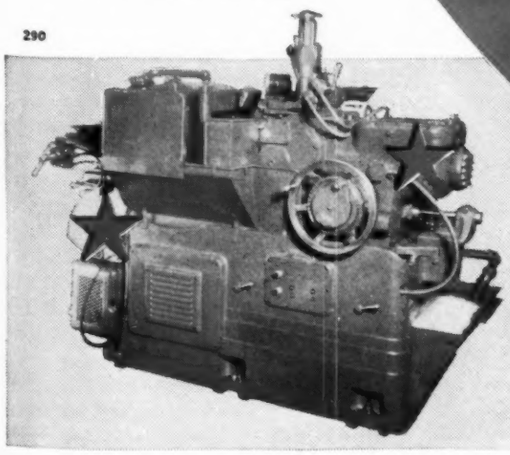
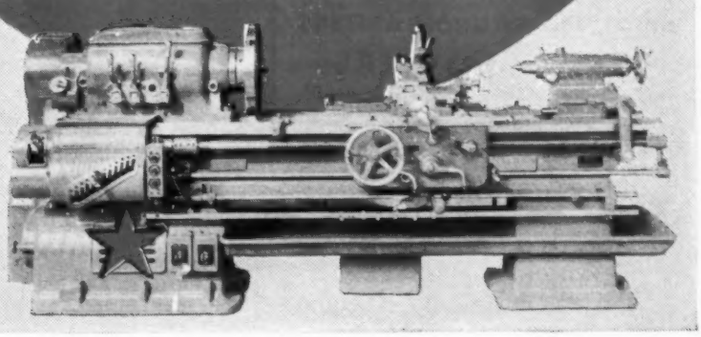
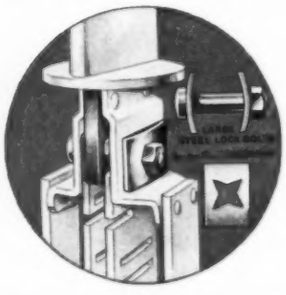




WARE HI-LAG



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Keep Motors Humming

- End Over-Heating
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WARE Renewable HI-LAG FUSES

SLOW MOVING industrial merry-go-round which handles Joaquin's pottery line. Originally, lamps were placed above and below the moving rack but bottom lamps proved unnecessary.

Infra-Red Solves Bottleneck

Late last year, to increase production, the Joaquin Potteries of Stockton, Cal., installed two gas fired kilns to replace batch type kilns. The new kilns increased production to such an extent that a bottleneck problem arose in the drying of the glaze dip prior to firing.

Application of infra-red drying as illustrated solved the problem. Cups and saucers and smaller pieces are hand dipped and carried by conveyor through the tunnel of 60-250 watt lamps mounted in standard gold plated reflectors. Any ware which comes from the kiln with imperfections in finish can be redipped and dried sufficiently in one trip under the lamps.

Operating advantages are reported as follows: almost no returns for redipping and drying; considerable saving in floor space; can use wooden conveyor construction.

Precision Timing for Spot Welds

Making a spot weld is a precise process with several rigidly controlled steps. A typical resistance-welding cycle may last from a tenth of a second to three or four seconds, depending on the kind and thickness of metal welded. The total time of a weld is further divided into the various intervals in which the welding machine goes through its operating sequence, and includes a "weld" period (3 to 30 cycles) when the full welding current flows. Sometimes, when welding thick plates or plates of brass or stainless steel that call for careful and critical welding, the material is welded not in one, but in several heating and cooling steps intermittently. A controller for this surface has an "overall weld" timing sequence, subdivided in several "heat" and "cool" steps, each ranging from 3 to 30 cycles.

This timing is now done by a new controller developed by Westinghouse using plug-in telephone type relays for compactness and thyratron tubes to actuate them. The operator, in order to establish the automatic timing sequence for the job at hand, simply places the plugs in the proper holes in the panel of the controller. The controls are mounted on hinged deadfront panels, which, for maintenance, can be swung open by removing a single bolt.

Patching with Electric Heat

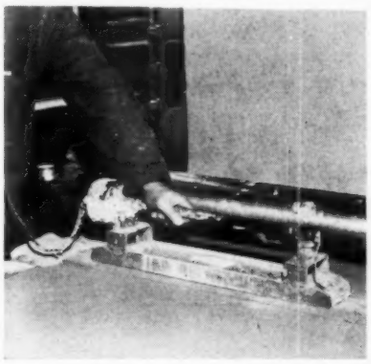
Every hour, approximately two miles of asphalt roofing is turned out with the aid of electric heat at the Weaver-Wall Roofing Company, Cleveland, Ohio.

Rag felt, the base in making this asphalt roofing, is picked up by a conveyor system which forms it in a series of long loops from the floor to the roof. In this way, many yards of reserve felt are provided so that when a roll is exhausted the processing machinery will operate on the slack until a new roll can be added.

New rolls are added by painting the ends of both rolls with a solution of sodium silicate and then heating them until the ends are fused together. Heat

is supplied by two home-made irons constructed of standard steel channel, junction box and fittings, and heated by two G.E. 500-watt strip heaters.

From the feeding magazine, the felt is thoroughly saturated with asphalt. After cooling, the felt is given another



TWO ENDS of the rolls are being fused together by this home-made fusing iron. (General Electric photo.)

coating of heavier asphalt. Three 350-watt and four 500-watt strip heaters are fastened to the pipe to offset radiation. These pipes and heaters are covered with asbestos to keep heat losses to a minimum.

Method for Low-Voltage Circuit Protection

Cascading or series connection of suitably coordinated air circuit breakers is a practical and economical system of protection for low-voltage radial feeder systems. It is a solution to the problem of providing adequate short circuit protection for low-voltage distribution systems and circuits operating at 600 volts or less.

In the event of a severe fault, the main power supply or transformer breakers "back-up" the feeder breakers, and these in turn back-up the branch feeder breakers. Only the main breakers need have interrupting ratings equal to the obtainable short-circuit current, yet the system is adequately protected.

Cascading also makes possible a simple means of selecting air circuit breakers to provide economical yet adequate protection for relatively small installations, where a complete short-circuit study might be difficult to justify and where a poor selection of protective devices would result in either an unnecessarily expensive installation or a serious hazard—generally the latter.

Not all combinations of air circuit breakers will operate effectively in cascade arrangement. Recommended are circuit breakers of the conventional magnetic type, somewhat larger and of greater thermal capacity than the cor-

HYFLEX has been used as shock-absorber strip along edges of windshield glass.

Low temperature resistance is furnished in the flexible connection between motor and windshield defroster of a famous American fighter plane, by HYFLEX.

Outlet tube of C-O-Two Fire Extinguisher (carbon dioxide, snow type) is covered with HYFLEX to protect hands against cold.

HYFLEX extruded plastic tubing has been accepted by many war production industries as an alternate for rubber tubing. Some of its present uses as tubing are for pilot relief, battery drains, and the conveying of hot air in defroster systems. Channels of HYFLEX have been used as shock-absorbing holders for automotive windshield glass. Strips of it are utilized as buffers between metal parts.

HYFLEX is extremely tough, with tensile strength of 3,000 lbs. per sq. in. Dry to the touch, this Fibronized product is free from soapstone and talc which are often used to eliminate tackiness in rubber. Moreover, it has good weathering properties and will not oxidize. Because HYFLEX makes its own bond, it can be sealed by pressing the ends together after they have been sufficiently heated.

Test HYFLEX for your own use. Send for a sample. Write Dept. 96.

OTHER TECHNICAL DATA

Originally designed for use as electrical insulation, HYFLEX has the following dielectric strength: Dry 850 VPM — Wet 815 VPM. • HYFLEX has resistance to brittleness down to sub-zero temperatures. • Wemco Oil Test (48 hrs. at 100 deg C.) . . . passed satisfactorily. • Will withstand continuous operating temperatures up to 170 deg. F.

Wall Thicknesses, Colors and Sizes Available: HYFLEX can be obtained in standard-wall and heavy-wall tubing (on size ⅜" I.D., standard-wall thickness about .025"; heavy-wall thickness about ⅛").

It is available in black, yellow, green, white, red and blue and is manufactured in 3-ft. and continuous lengths in A.S.T.M. sizes 14 to ⅝" I.D. For sizes larger and smaller than these and for channels and special-shaped strips, please submit your requirements.

TRANSPARENT PLASTIC TUBING

TRANSFLEX TUBING has all the properties of HYFLEX; but in addition is transparent and permits wire identification when used as conduit for electrical systems.

STANDARD OF THE WORLD
IRVINGTON INSULATION
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IRVINGTON VARNISH & INSULATOR CO.
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Plants at Irvington, N. J. and Hamilton, Ont., Can. Representatives in 20 principal cities

If anyone can

YOUR ELECTRUNITE DISTRIBUTOR CAN

Maybe we make it seem too easy. It isn't always a "snap" for him to solve electrical supplies problems these days—but he will do his best to find an answer, even though it may take hours of studying customers' needs, juggling stocks and utilizing his broad knowledge and experience in the electrical industry.

He's ready to sit down and help you plan a job any time. But don't wait until the last minute. Give him information in advance. Ratings and symbols are most important, and he'll be able to tell you what to do about them.

The story of your job—materials needed, when you'll need them, the end use, the purchaser's symbol, the allocation classification symbol and the priority rating or extension—all this is the stuff that enables him to give you the kind of service on which he has built his reputation. Too, if your ratings don't happen to be high enough, he's the fellow who can best advise you on alternate selections. It's the basis of his business to be well informed on these things.

Get acquainted with your ELECTRUNITE DISTRIBUTOR. Tell him well in advance about your important jobs and he'll "go to bat" for you. He maintains contact with manufacturers of all types of electrical supplies. He'll do everything possible to get the job going on time and to keep it on schedule. If anyone can lick your problem, he can. So always see him *FIRST.*

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"Inch-Marked" ELECTRUNITE STEELTUBES PROTECTS WIRING . . . SAVES STEEL

Because it is made of steel, ELECTRUNITE STEELTUBES provides the dependable *protection that vital wiring needs today. And—because it is designed for use with compression-type fittings and does not require extra steel as a base for threading—this streamlined raceway SAVES STEEL. An installation of 100,000 feet of ¾" size instead of ordinary threaded conduit will save enough steel for a 30-ton tank. On thirty jobs of this size enough steel could be saved to build a destroyer. The "inch-marking" on every length and the ELECTRUNITE Bender help save steel, too—by reducing chance for error and wasted material. And—with compression-type fittings added—construction can be stepped up to meet rush demands, with less "back-breaking" effort.*

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THE ELECTRICAL RACEWAY WITH A

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NTINUOUS FOOT-RULE ON EVERY LENGTH!

Better Bearings *For* Motors At War

● Bunting Bronze Electric Motor Bearings provide the rugged strength, the greater wear and shock resistance, together with superior anti-frictional qualities, required by motors now carrying war production loads for long sustained periods of operation. Readily obtained from local wholesalers. The Bunting Brass & Bronze Company, Toledo, Ohio . . . Warehouses in All Principal Cities.

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With the famous Powder-Packed Element

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Lock fuses and clips together

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With genuine fibre tubes (not paper)

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The color tells the size

FUSE PULLERS
Pull and replace fuses safely

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Glass and Unbreakable types for every application. Stops guesswork - bearing failures - waste - idle machinery, etc.

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Hold Woodscrews

In Tile • Marble • Slate • Mosaic • Brick and Wood Furring

Fig. 950 Lead Type

Keep a few of these handy PAINE Pull - Out - Proof Woodscrew Anchors in your tool kit. Get faster, safer fastenings for electrical fixtures and equipment. Get a workman-like job. Save time and temper.

Easily and quickly set in anchor hole without a setting tool. A definite protection against wall fractures. Both types expand uniformly under screw pressure to assure a firm grip.

Fig. 955 Fiber Type

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FASTENING and HANGING DEVICES

responding thermal breakers which are familiar.

Smaller breakers used in the cascade arrangement must have the following requirements:

1. They must be capable of mechanically withstanding the "impact" resulting from the electromagnetic forces set up by the excessive current, preferably equipped with a quick-acting instantaneous tripping mechanism.

2. They should not otherwise be restrained from separating their contacts nor from transferring the current from contacts to interrupting unit. Undue delay may cause serious damage, but rapid current transfer, preferably accelerated by the electromagnetic forces previously referred to, will transfer the burning from the contacts to the arc runners where even a considerable amount of burning will not impair subsequent current-carrying ability.

3. Their interrupting units must be capable of withstanding arcing for such time as the "back-up" breakers may require to interrupt the current.

Interrupting Capacity

Because the "back-up" breakers must protect not only the circuit but also the smaller breakers, here are the following requirements for them:

1. They must trip whenever the current reaches a value equal to or slightly less than the interrupting rating of the smaller breakers next in line.

2. They must completely interrupt this current just rapidly enough to avoid serious damage to the smaller breakers, yet not so rapidly as to participate unnecessarily in the actual interruption of current, thereby requiring unnecessarily increased maintenance. A reasonable and effective solution is that the "back-up" breaker need not actually separate its contacts in less than the normal interrupting time of the smaller breaker next in line, so long as the current does not greatly exceed the rating of the smaller breaker. However, the operating time should become proportionately shorter at higher currents in order to obtain better circuit protection.

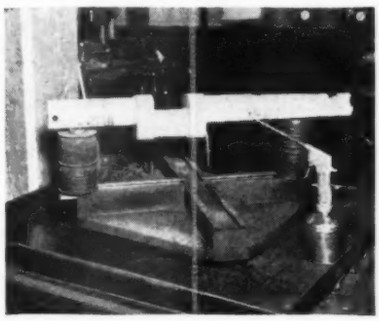
Three circuit breakers in cascade is maximum needed for today's requirements. In this arrangement, the calculated short circuit duty placed on the air circuit breaker nearest the low-voltage source must be within its published interrupting rating. The second air circuit breaker must be within 200 per cent of interrupting rating, and third must be within 300 per cent.

Severe faults will occasionally trip the "back-up" breakers and thus interrupt power supply to some circuits not in trouble. However, these faults are not common and most of the troubles will be taken care of by the individual feeder breakers.

Test for Crankshaft Cracks

Power presses are given careful periodic tests at the Schenectady works of G. E. Each time a shaft is removed from the punch-press for any reason a test is made, it is made as a safeguard, because the crankshafts are subjected to tremendous strain in operation. Recently a group of 43 shafts were tested using this method and 14 of them were found to be cracked and required replacement.

The test is magnetic and consists of magnetizing the shaft, making the direction of flux longitudinal so that it will



SHAFT of punch press set up for magnetic test for detection of fatigue cracks.

intercept any possible cracks at right angles. While magnetized, the shaft is sprayed with kerosene which has in suspension finely divided particles of magnetic iron-oxide. Any cracks will set up magnetic poles which are strong enough to attract and hold the iron-oxide particles, outlining a crack which is visible to the naked eye.

Infra-Red Speeds Dry Processing

The increased use of Van Dykes to meet wartime production schedules resulted in a careful time study analysis of the printing process. Biggest time losers were in print drying and in repeat orders due to rejects from distortion.

Production of these Van Dykes has been speeded up 350 per cent, and the number of rejects are entirely eliminated by use of infra-red drying. Savings on the operation are approximately $300 per month.

The old method required ten minutes for drying and the squeezing often distorted prints that had to be to scale.

With infra-red on the job, drying time has been reduced to three minutes. A total of twelve 250-watt lamps have replaced the drying unit and the steel roller used for squeezing. Prints up to 102 x 36 in. can be hung beneath lamps strung in three rows nine inches apart.

PUT THEM THROUGH THE MOST GRILLING EXAMINATION

The more severe and exacting your requirements the better we like it . . . because that gives us an opportunity to prove the truly SUPERIOR value of our

BRUSHES

New problems are facing the engineer and production managers of industry today. Where the Victory Program calls for no let up, Superior Brushes are meeting the challenge for extra durability, extra finesse, and fidelity of uniformly correct physical and electrical specifications.

For carbon, graphite, and metal-graphite brushes, be on the safe side by specifying SUPERIOR.

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"All That SCP the Name Implies"

And there's just as much difference between the *streamlined* BRIEGEL METHOD of making conduit connections and former, old-fashioned methods!

Take a look at the picture below: two squeezes with the patented B-M "indenter" (which costs only $1.25) and you have a smooth, efficient job when you use B-M connectors and couplings. No extra turns or twists—no nuts to tighten!

The BRIEGEL METHOD saves you up to 50% on time and a substantial materials-saving (in keeping with today's thinking). Means more profit, too! Approved by Underwriters' Laboratory, of course.

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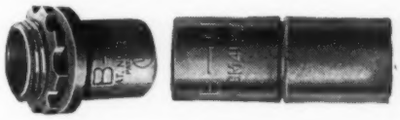

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Reader's QUIZ

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay $5.00.

GENERATOR FOR CHARGING BATTERY

QUESTION 60. On a generator for charging a 50 volt locomotive battery, when the battery was almost fully charged the polarity of the generator started to reverse. How can I remedy this condition? We have no spare.

Our generator was a d.c. shunt motor, 5 hp., 115 volts, 38.8 amps., 1100 rpm., coupled to an a.c. motor, 7½ hp., 1175 rpm. The battery was in series with two parallel resistances of 3.35 ohms each. When we first connect the battery the generator charges at the rate of 25 amps. at 90 volts.—C.B.

A. TO QUESTION 60. For charging a battery of this kind it would be helpful to have a generator provided with voltage control so that the voltage may be raised if the battery voltage gets too high. I do not see how it would be possible to raise the voltage of a 50 volt battery so high as to reverse a 90 volt generator unless the trouble comes because your voltage is so low that your field poles are not magnetically saturated. A shunt generator operating below the point of saturation is unstable and it might help to increase the field current (excitation) and so raise the voltage. It would then be necessary to use a higher resistance in the charging circuit.—J.E.W.

A. TO QUESTION 60. It is generally advisable to install reverse current and overload devices with battery charging equipment primarily as a protection for the battery against unnecessary rapid discharge. At the same time, protection is also afforded to the equipment in general. When a shunt generator is used for charging, the same precaution should be taken, because if for any reason the field becomes weak or open-circuited, the line current will reverse. This may also happen if any of several other failures in the generating unit should occur. However, the relative polarity will remain unchanged.

In many cases, charging a battery with a resistor in series proves disadvantageous, especially in this instance where 46.5 per cent of the energy is dissipated in heat. This leaves but 48.1 volts impressed upon the battery with which to overcome the internal IR drop plus the terminal e.m.f. Consequently, the battery cannot attain full charge. Even under this condition, however, if the battery is of sufficient capacity, it is possible for the line current to reverse when a fault with the generating unit develops.—O.A.

A. TO QUESTION 60. If the generator is shunt wound the polarity of its field will not reverse, even if it should be motorized by the battery, due to the drop in generator voltage or to the failure of the alternating current power. The current in the armature will be reversed, thus the generator will run as a motor with the same direction of rotation. A direct-current reverse-current relay may be used to open the circuit breaker of the direct-current circuit if its current is reversed; thus preventing the discharge of the batteries should one of the above faults occur.—L.H.M.

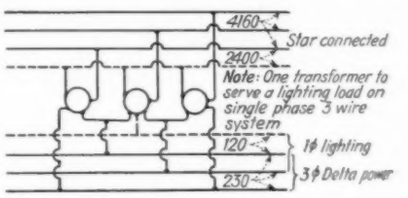
A. TO QUESTION 60. Your field coils may be reversed. Shut down the machine, open shunt field, but do not open shunt field with machine operating as this may kill or reverse field pole magnetism. Start machine, connect voltmeter so voltage shows. The residual magnetism will show a low voltage of about five volts. Now watch voltmeter and connect shunt field. If the voltage increases ok but if the voltage reverses, the shunt field coils are connected wrong and will have to be reversed. Check brushes to see if they are on operating neutral.

When a motor is changed to a generator the rpm. has to be increased about 30 per cent. Understand your machine operates at 1175 and believe this is too slow. Would try about 1400 rpm. or fast enough to get all the voltage you need. —W.L.C.

TRANSFORMER CONNECTIONS

QUESTION 61. The accompanying diagram shows a bank of transformers, star connected primary, delta connected secondary, with a tap for single phase three wire lighting on one transformer.

For a 30 kva. power load and a 15 kva. single phase, three wire



lighting load, what size should each transformer be, how would you calculate it and what sizes would be required?

The transformers were connected star to star, the high side of the transformers are connected to 4160 V. star, 2400 V. to ground. —C.P.L.

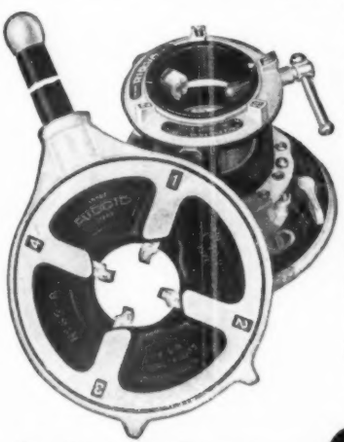
A. TO QUESTION 61. For the load given I would recommend using one 25 kva. and two 15 kva. transformers. This will be slightly more capacity than the actual load requires. In a closed delta bank, in which all transformers are the same size and have the same per cent impedance, with total single-phase load connected across transformer "A," as shown in the diagram below, the current will divide as follows: two-thirds of the single-phase load will be carried by "A" and the balance, or one-third, will flow through "B" and "C" in series.

In a bank of one 25 kva. and two 15 kva. transformers, assuming same per cent impedance in each, the 25 kva. unit will carry approximately 77 per cent of the single-phase load and the remaining 25 per cent will be carried by the two 15 kva. units in series. Adding this

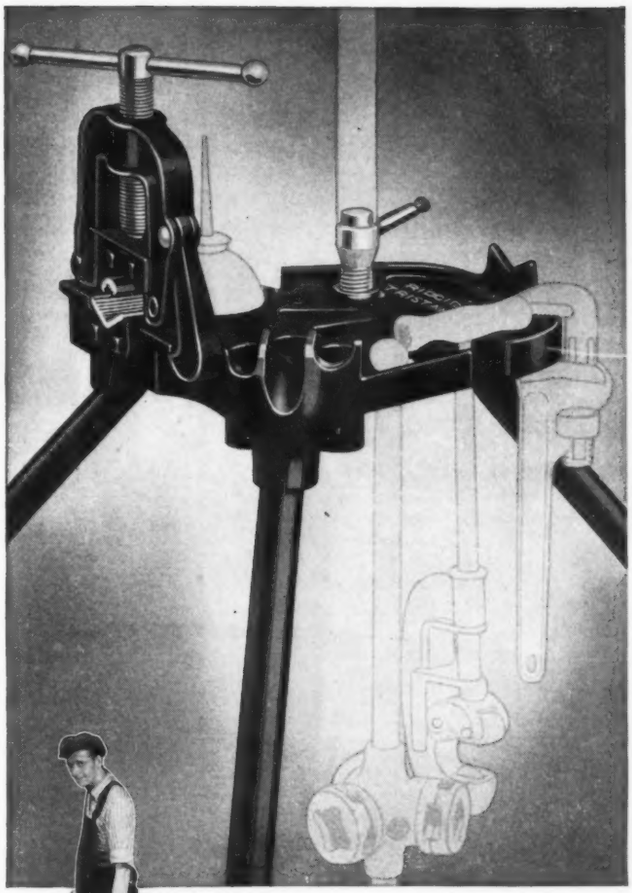
This Quicker Pipe Threading Also Speeds The Victory!

You set this RIDGID No. 65R to size in only 10 seconds . . .

It's a time-beater, a work-saver. It threads 1" to 2" pipe, 4 sizes, with 1 set of clean-cutting high speed steel chasers — no extra dies to lug around or fool with. You change size in a few seconds: screw up workholder, move setting post, screw it down again.



Speedy mistake-proof workholder sets instantly, one screw to tighten and *no bushings.* Any thread variations, any pipe — and it's made of rugged steel and malleable with drop-forged hardened steel cam plates. . . . It licks delays and waste of priceless time — ask to see it at your Supply House.



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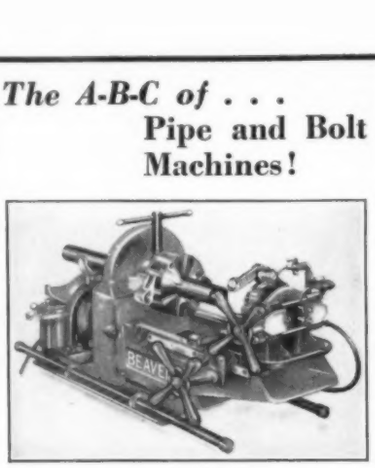
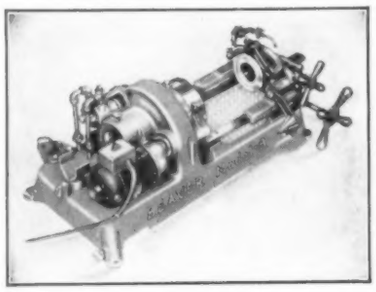


Beaver Model-A
A high-speed heavy-duty deluxe Pipe and Bolt Machine. Range 1/8 to 2-inch-up to 12-inch with geared tools and drive shaft. Bolts, 1/4 to 2-inch. Wt. 415 lbs.
Write for Bulletin A



Beaver Model-B
A light-weight utility Pipe and Bolt Machine combining many features of Model-A with the easy portability of Model-C. Range 1/8 to 2-inch up to 8-inch with drive shaft and geared tools. Bolts up to 1 1/2-inch. Weight 280 lbs.
Write for Bulletin B

Models C-1 and C-2
A STURDY LITTLE POWER UNIT Converts hand pipe tools into power tools from 1/4 to 8-inch. Threads 8-inch in 6 minutes. Threads bolts up to 1 1/2-inch. Two men can work at the same time without interference. Weight 150 lbs.
Write for Bulletin C

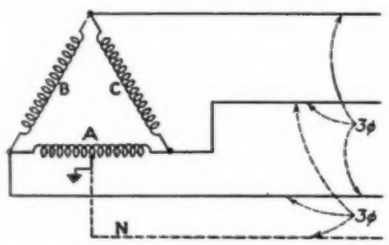
Write for new Tool and Machine Catalogue—Just off the press

BEAVER PIPE TOOLS
943 Deen Ave., Warren, O.

Reader's QUIZ

[FROM PAGE 68]

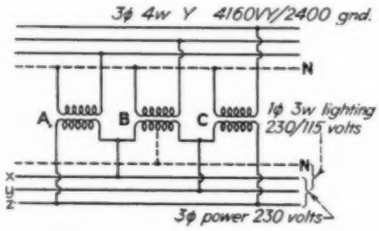
single-phase load to the three-phase gives approximately 21 kva. in the 25 kva. transformer and 12 or 13 kva. in the two 15 kva. units. This is based on the assumption of 80 per cent power factor for the power load and unity for



the lighting load. However, a slightly lower power factor on the single-phase will not make any appreciable difference.

A vector analysis of the problem would give slightly different values, but I believe the above is accurate enough for practical purpose.—R.L.M.

A. TO QUESTION 61. I assume that both the 3-phase delta power system and the single-phase 3-wire system are balanced. When three single-phase transformers are used for three phase transformation, each transformer need only be rated at one-third the total kva. So if your system was just power,



each transformer would be rated at one-third 30 kva., or 10 kva. each. But in your case, one transformer must carry 15 kva. lighting load in addition to its allotted 10. Thus in the diagram transformer B must be rated at 15 plus 10 or 25 kva. Remember, however, the size of wires x and y will have to be increased accordingly. The transformers A and B would, of course, be rated at 10 kva. each. (These ratings are only theoretical because they allow just enough capacity, the size of each one should be increased so as to allow for spare capacity.)

The above diagram and plan is not the best, although it may prove to be the most economical. Transformer B will have a tendency to "hog the load," and create an unbalanced condition which might be all right if it is not carried too far. The reason is that due to the added capacity, the impedances are not matched. This might be overcome by adding a reactance, but a better plan would be to provide a fourth transformer, if finances and space provide. —D.B.F.

A. TO QUESTION 61. The Y-delta system with a four wire primary, the fourth wire being connected to the neutral point of the three phase windings as shown in your diagram, and with a middle tap extended on one of the transformer secondaries to obtain a three wire single phase service for the lighting load, the size transformers, for the maximum demand given, would be one 25 kva. unit and two 10 kva. units. The middle tap should be extended from the 25 kva. unit to supply the lighting load. You have a 45 kva. load with transformer capacity of 45 kva. The units would divide the load as follows:

$$\text{25 kva. unit} - \frac{25}{45} \text{ or } \frac{5}{9} \text{ of the load.}$$

$$\text{10 kva. unit} - \frac{10}{45} \text{ or } \frac{2}{9} \text{ of the load.}$$

$$\text{10 kva. unit} - \frac{10}{45} \text{ or } \frac{2}{9} \text{ of the load.}$$

—V.M.

A. TO QUESTION 61. The available 3-phase power from three transformers connected to a 3-phase system will be $3\ E_Y I_Y \cos \phi$ or $3\ E\Delta I\Delta \cos \phi$, where E_Y is the Y or star voltage and I_Y is the Y or star current; $E\Delta$ is the Δ voltage, $I\Delta$ is the Δ current and $\cos \phi$ is the power factor. If the load is measured in kva. instead of kilowatts we can use simply $P = 3\ E_Y I_Y = 3\ E\Delta I\Delta$. For the single phase load, of course, the required capacity will be $E\Delta I\Delta$ if the transformers are Δ connected on the secondary as the diagram indicates.

$$30 \text{ kva} = 3\ E_Y I_Y = 3\ E_\Delta I_\Delta$$
$$\text{or } E_Y I_Y = E_\Delta I_\Delta = 10$$

It should be satisfactory to use three 10 kva. transformers and one 25 kva. —J.E.W.

CONNECTING THERMOCOUPLES TO PYROMETER

QUESTION 62. Why are the conductors of a twin conductor extension lead used for connecting a thermocouple to a pyrometer of different kinds of metal and what would be the objection to using a two conductor copper wire?—J.J.L.

A. TO QUESTION 62. The e.m.f. generated by a thermocouple depends on the temperature difference

between "hot junction" and "cold junction." Only if the cold junction temperature is kept constant, or if its variations are compensated for, the instrument (pyrometer) can directly be calibrated in hot junction temperature.

Most instruments contain devices which compensate for such variations of the cold junction temperature. However, these devices operate correctly only if the cold junction has the same temperature as the compensating device. For that reason, the cold junction has to be brought to the instrument. This can be accomplished only by lead wires which are made of the same metals as the thermocouple proper.—L.F.R.

A. TO QUESTION 62. Generally all thermocouple extension leads should be of the same material as the thermocouple. However, up to 200° F. there is no particular advantage in using lead wire of the same material, except for uniformity of installation. If the lead wire used is of a different material from the thermocouple a cold junction compensator should be installed at the point where the lead wires connect with the thermocouple. Usually pyrometers have the compensator incorporated in the pyrometer itself, therefore, general practice is to use lead wire of the same material as the thermocouple up to the pyrometer.—J.A.H.

A. TO QUESTION 62. Twin conductor thermocouple wire is made up of two different metals to maintain a constant resistance even though the temperature of the leads may change. The conductors must also be connected to their respective terminals or the error will be increased, rather than decreased.

Copper wire would not work satisfactory due to the change in resistance with a corresponding change in temperature.—L.R.A.

A. TO QUESTION 62. Theory and elementary experiments show that a good conductor of electricity is also proportionately a conductor of heat. This involves the chemical structure of the material. Electricity can produce heat in a conductor, conversely, if the complex relationship between heat conductors and electrical conductors is partly governed by the displacement of electrons, heat can produce an electric current, however small, or a difference of potential, involving also the effective resistance of the conductor. If an instrument of sufficient accuracy and magnifying power can be constructed for practical use it may be possible therefore, to use two copper conductors for a thermocouple.

Thermoelectric graphs of various conductors may be found in technical textbooks. These show the difference in

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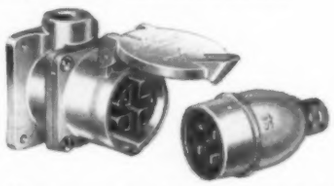
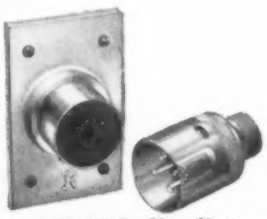
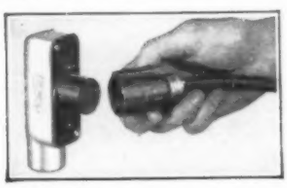
General Purpose plugs and receptacles: 1, 2, 3, 4, 5 poles, ratings 30, 60, 100, 200 amperes. Round prong contacts, rugged cast metal housings to withstand severe service.



QuelArc circuit breaking types: 2, 3, 4 wire types, ratings up to 200 amperes. Exceptional protection to contacts, for safe use as current rupturing devices.



Triploc and Multiple Circuit plugs and receptacles: 1, 2, 3, 4, 6, and 8 pole contact units, allowing assembly in combinations up to 32 poles. Manual and automatic release features. Ideal for portable tools, pyrometers, signal and control circuits.



Midget Triploc, compact, but with many exclusive heavy duty features for dependable service under severe conditions: 2, 3, 4 pole types.

Write for your copy of Pylet Catalog 1100 with complete listings of all types.

The Pyle-National Company
1344 N. Kostner Ave. Chicago, Illinois

Reader's QUIZ

[FROM PAGE 71]

potential which can be obtained with a combination of different metals. Unlike conductors produce sufficient deflection in pyrometers for practical and accurate measurements.—O.A.

REMOVING OLD WIRE

QUESTION 63. We have a problem of removing old wires from conduits to permit rewiring and clearing a number of short circuits. Condensation has moistened and rotted the insulation so that we cannot pull out the old conductors. If you have had a similar experience, we would appreciate some suggestions on how the wires may be withdrawn.—E.F.

A. TO QUESTION 63. We used a 5 kva. transformer 115-230 volt primary 11.5-23 volt secondary, we used 115 volts on the primary, and 11.5 on the secondary, attaching secondary leads to old wire, so that the old wire in the conduit formed a resistance.

This method caused quite a lot of smoke, but it did the job. We were able to remove old wire, and replace with new. If you have had experience thawing out frozen water mains with transformers, you now have a similar situation, calling for the same procedure.—W.H.L.

A. TO QUESTION 63. The use of a soda solution (Drano, Sani-Flush, etc.) was one of the most novel methods we heard about being successfully used to loosen old conductors, so that the conduit could be cleared. Of course, this was on an underground installation. One would have to be careful to thoroughly flush and swab the conduit before pulling in new conductors.—J.M.T.

A. TO QUESTION 63. A possible suggestion for this trouble where the insulation crumples and forms a mass tending to wedge the conductor within the conduit is to apply an isolated current (from a welding machine, etc.) and heat the conductors above operating temperatures. Attach the conductors on each end to a steel guide wire and pull back and forth while gradually advancing toward one end.—O.A.

A. TO QUESTION 63. We have had a great deal of experience removing wet and rotted wire from conduit that was submerged in the 1937 Ohio River Flood.

The most satisfactory method found to remove the wet and rotted wire was to cut the conduit and remove a few lengths. By doing this we were able to remove the wire easily in all runs of conduit. When the conduit was put back up, a box was put back in where the conduit was cut. All conduit was dried out by pulling swabs through before new wire was installed. Some conduit laid in concrete had to be abandoned and new conduit was run on the surface to take its place.—R.C.M.

A. TO QUESTION 63. I have had a similar experience in a large refrigerator building. Ninety per cent of the plugged conduits were cleared as follows. A small pressure oil can was filled with kerosene. This was injected into the conduit so the oil would tend to flow by gravity. After soaking for a short time the conductors would come out easily.

In more stubborn cases a fish wire with end closed on itself was forced in. This would carry the oil to the bends and in some cases break small arc spots. The conduits are then swabbed dry and powdered with chalk to remove excess oil.—M.F.

Can You ANSWER *these* QUESTIONS?

QUESTION T2 —What is the function of a starting compensator in connection with a two-lamp ballast used on a fluorescent lighting fixture? Why is it always connected in the leading ballast circuit?—L.H.M.

QUESTION U2 —On one of our motors equipped with a conventional across-the-line magnetic starter, I would like to extend a circuit to a pilot light which will light when the starter trips due to an overload. Can one of your readers suggest a circuit hook-up which will do this?—R.P.

QUESTION V2 What are the advantages and disadvantages of three phase power circuits wired as follows? Delta connected primary and Y connected secondary with secondary ground common to both secondary electrical center and primary equipment such as transformer cases and arresters. I have several banks of 50 kva. and over wired Y to delta ungrounded now. Grounds have developed in one building and damaged motors in another building where the ground was not indicated by 220 volt lamps wire to ground from each phase.—J.J.G.

PLEASE SEND IN YOUR ANSWERS BY OCTOBER 1

MOTOR CONTROLS
for every kind of machine

Complex or Simple

Each motorized machine has its own operating cycle . . . its own working conditions . . . hence its own control requirements. To meet the demand for "standard" controls that will fit "special" applications, the Allen-Bradley line comprises an amazing variety of controls and accessories.

Standardized A-B control units can be made up in special panels for complex machines or supplied in various enclosures for simple, one-motored machines. A few of the many units and enclosures in the A-B line are shown on this page. Write for bulletins.

General Purpose

Corrosion Proof

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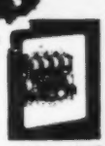
Non-Haz. Dusts

Non-Cor. Gases

Corrosive Gases

Hazardous Dusts


Wall Mounting

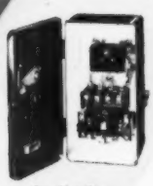
Pedestal Mounting

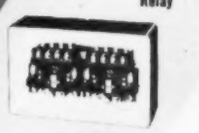
Complete Panels

Reversing

Automatic

Manual


Combination


Multispeed

Relay

9 Types of Enclosures

The surest way to get long, trouble-free starter operation is to select the correct type of enclosure for each installation condition. The A-B line has an enclosure for every type of service.

Complete Panels

When motorized machines require inter-connected control, a multiple unit panel is the logical answer. Let A-B engineers work out your special control requirements with standard A-B controls.

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QUALITY

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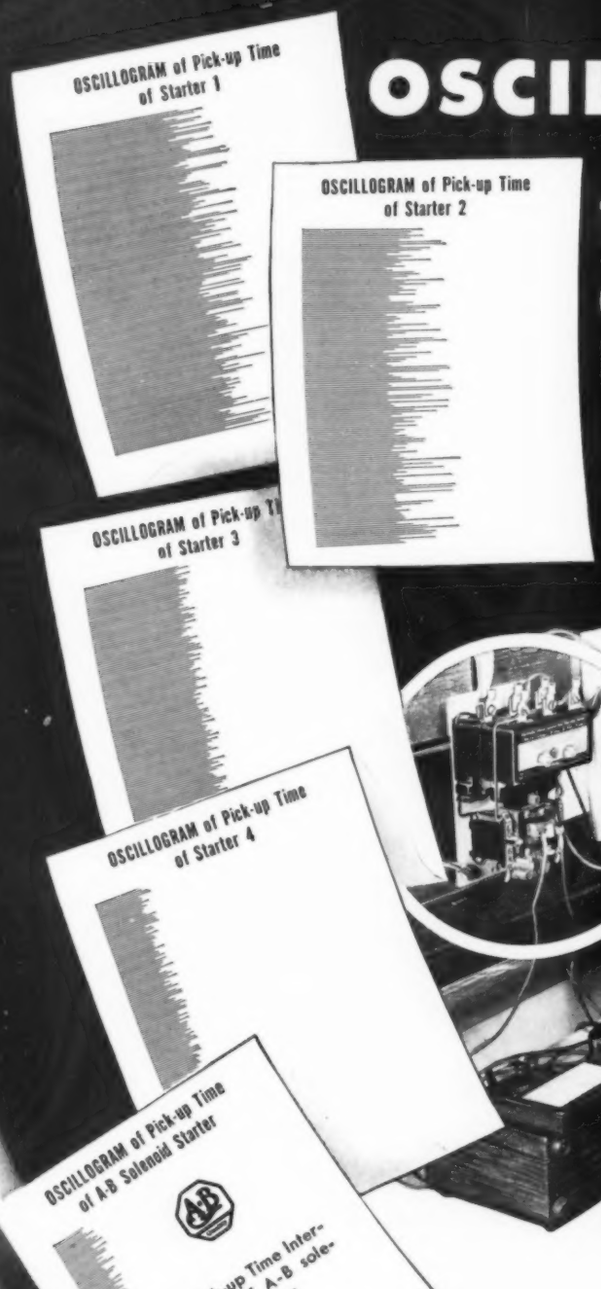
OSCILLOGRAPH TESTS

tell startling "speed" story about standard magnetic starters


OSCILLOGRAM of Pick-up Time of Starter 1
OSCILLOGRAM of Pick-up Time of Starter 2
OSCILLOGRAM of Pick-up Time of Starter 3
OSCILLOGRAM of Pick-up Time of Starter 4
OSCILLOGRAM of Pick-up Time of A-B Solenoid Starter
A-B
Pick-up Time Intervals of A-B solenoid starter
Shortest . . 0.0141 sec.
Longest . . 0.0211 sec.

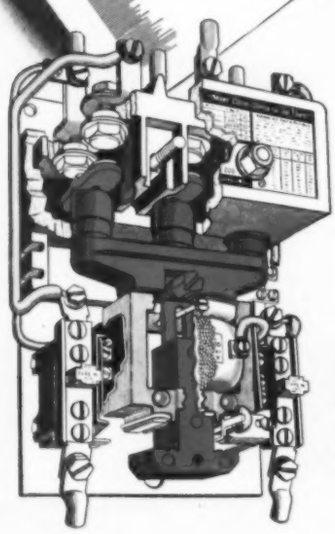
Oscillograph Test showing A-B starter during pick-up test.

Five different makes of standard magnetic starters of like ratings were recently put through 150 rapid fire pick-up tests. The results were recorded impartially by an automatic oscillograph. Here they are!

These five oscillograms tell their own revealing story. The long, ragged lines in the first oscillograms signify long, uncertain pick-up intervals, after closing the pilot circuit. The short, even lines in the bottom oscillogram mean that the Allen-Bradley solenoid starter closed always in short, uniform pick-up intervals. No other starter equaled this split-cycle performance.

That is the kind of response needed for precision sequence control on machine tools. Is it any wonder that A-B solenoid controls are used as standard equipment by so many machine tool manufacturers?

Allen-Bradley Company, 1307 S. First St., Milwaukee, Wis.



ALLEN-BRADLEY

SOLENOID MOTOR STARTERS

QUALITY

More Gossip

Contractors Entertain Wholesalers

Local Electrical Contractors and wholesalers who sometimes don't see eye-to-eye, forgot past differences when they met jointly in Chicago recently. The wholesalers were guests of the Cook County Electrical Contractors Association at a get-together designed to promote closer contractor-wholesaler relations. The boys really took to each other and everyone had a swell time.

Back From Pearl Harbor

Fred Raetz, son of Ed Raetz, president, Rochester Electric Co., Rochester, Minn. and past-president, Minnesota Electrical Council, has returned home from Pearl Harbor. Fred, who was engaged in construction work there during and since the Jap attack, was fortunate enough to have eluded the Nip bullets.

Unique Hook-Up

G. K. Williams, general manager, Hamilton Sterling Electric Co., Hamilton, Ontario, spends his spare moments to good advantage. He recently developed a unique hook-up for welding circuits which eliminates the breaking of main generator circuits, lowers installation cost and simplifies the operation of welding units. Hamilton Sterling's customers are reaping the benefits of G. K.'s engineering talent.

TOUGH JOB confronts (L to R) G. K. Hardacre, Public Service Co. of Northern Illinois; Charles Dornbusch, Chicago architect; and R. S. Everitt, Kansas City Lighting Institute, three of eleven judges studying entries in the midwest regional contest of the National I.E.S. Lighting Competition in Chicago. Contest was open to students of approved architectural schools.

Beware of Sabotage

"Watch Out for Sabotage" is the title of a special bulletin recently issued by Paul Muller, chief electrical inspector, Electrical Inspection Dept., New Orleans, La. In it he calls attention to local electrical fires causing appreciable losses of vital materials and encourages cooperation with the department in preventing sabotage and fire loss of materials, property and equipment. This is one way of making residents safety conscious.

A Scrappy Wallop

A sizable wallop to our Axis enemies was recently delivered by the Arthur Wagner Company, Chicago motor service shop when they gathered together and sold better than 150 tons of scrap metal in the form of obsolete motors, rails, bases, pulleys, conduit and other items which eventually will find their way into enemy territory as materials of war.

When the company recently moved to new headquarters, a complete inventory of stock revealed the accumulation of scrap that had piled up over a period of years. Says Arthur, "It's not only a patriotic duty but also a business responsibility to get rid of the stuff."

Motor Shops to Expedite Copper Deliveries

The Industrial and Commercial Division members of the Cincinnati Electrical Association are planning a copper stock reduction with the idea of helping Uncle Sam thaw out inventories of slow moving magnet wire.

The plan will operate as follows—Individual inventories of surplus stocks will be reported to a local clearing house with an offer to sell each other at present mill list prices. A priority rating, A-1-k, or higher—same as on purchases from mill or distributor—will be required for purchases through the clearing house. The plan is designed to provide a substantial reduction of combined surplus copper stocks and make for quick delivery to buyers needing wire.

Ideas Galore

Inventors have nothing on Frank (Pop) Mielke, electric motor expert of Duluth, Minn., when it comes to dreaming up schemes for speeding up motor repair work and doing a better job. The Mielke Electric Company shop, one of the best equipped in the north middle west, is just teeming with gadgets that reduce work and cost.

"Pop," one of the grand old men of NISA, can take a junk lathe, that has long given up the ghost, and rebuild it into a winding head that does everything but talk. And his son, Warren, is following right in his dad's footsteps.

RECREATION ADVOCATE, A. F. Anderson, Nashville, Tenn., hies to his hunting and fishing club in the Tennessee hills to enjoy what spare time he gets. In business, he is president of Anderson's', Inc., Nashville motor service shop.

Radio Service Instructor

Val Zentz, member of the Minnesota Electrical Council from Elmore, Minn. is now a Radio Service Instructor for the Army Signal Corps Radio Servicemen at the Lincoln High School, Mankato, Minn. Val says that additional instructors are urgently needed and that candidates must have practical experience and thorough knowledge of radio circuits together with the ability to impart such knowledge to the trainees. Val is now located at 234 Clark St., Mankato, Minn.

In Naval Air Corps

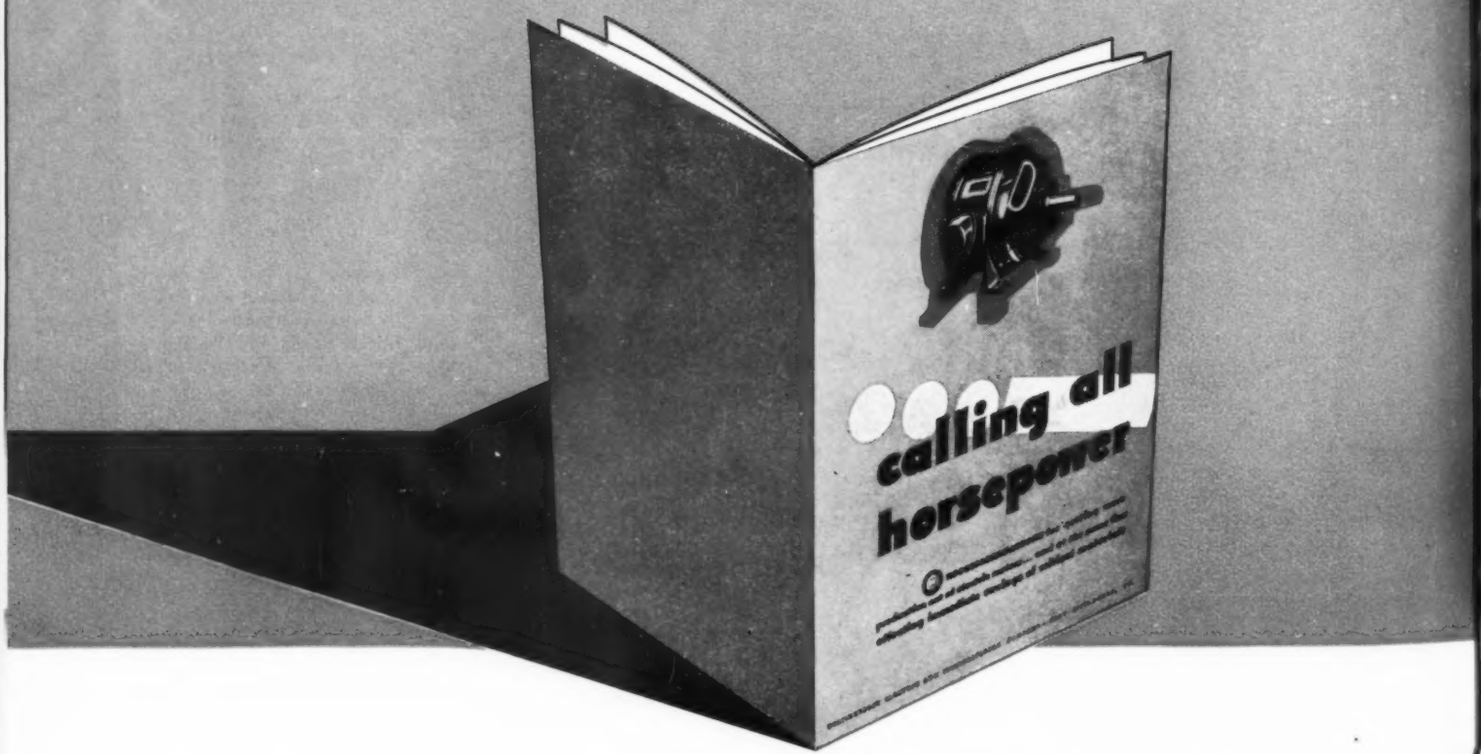
Bob Collins, youngest son of Walter Collins, secretary, Electrical Contractors Association of City of Chicago, is keeping 'em flying at Corpus Christi, Texas. Bob, whose first love is flying, is making rapid strides as a Naval Air Cadet. While waiting call to active duty, Bob was helping his dad in the research department of the Electrical Contractors Association of City of Chicago.

Celebrates 27th Anniversary

Roy Springer, president, Ross Electric Co., electrical contractors and dealers of Superior, Wis., celebrated his 27th year in the electrical business on Sept. 1, 1942. Roy's appliance business has been hit pretty hard by wartime restrictions, but he is "up and at 'em" so far as construction work goes. He just finished a housing project as a joint venture with Irving Christopher of Belknap Electric Co., Superior, and is keeping his eye peeled for ship wiring opportunities along the lake.

ELECTRIC MOTORS ARE BUILT WITH EXTRA RESERVES OF POWER FOR EMERGENCIES....

use EMERGENCY motor power now!



In peacetime, motors are applied with a substantial reserve safety factor. In other words, most applications are "overmotored" . . . the motors are capable of producing more horsepower than is required by the machines they drive.

Such "overmotoring" provides a reserve to take care of unexpectedly heavy loads, and assures long life with low maintenance cost.

But today, our problem is to "make the most of what we've got"—to get more production out of each and every motor.

Recognizing this fact, Westinghouse, at the suggestion of the War Production Board, now recommends that motor users modify their peacetime practices . . . that they get the most out of every motor they have . . . that in applying new motors or relocating old ones, they take advantage of all possible favorable operating conditions . . . that they load each motor to the limit.

A summary of these recommendations is presented in the booklet "Calling All Horsepower," illustrated above. Ask today for your free copy. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-21250

Westinghouse

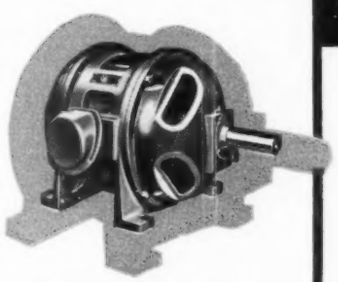
THE WESTINGHOUSE "CALLING ALL HORSEPOWER" PROGRAM IS DESIGNED TO:

- **Get maximum production out of every motor.**
- **Save critical materials.**

The program has as its basis close teamwork between industry and Westinghouse engineers, aimed at determining with maximum accuracy the exact horsepower required by the driven machine.

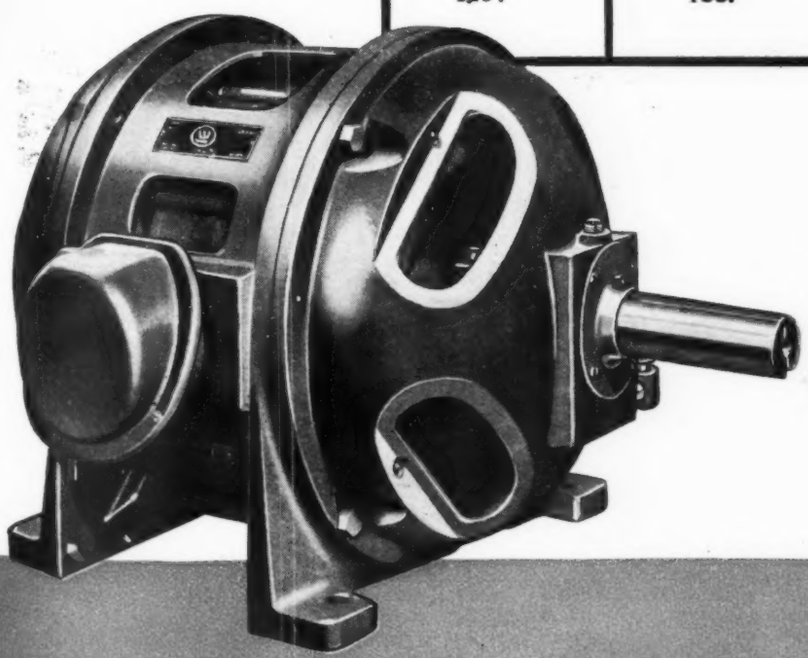
In keeping with these findings, it then offers specific recommendations which will enable users to take advantage of (1) all favorable operating conditions; (2) extra service factors built into Westinghouse motors. Some typical results possible with this program are shown in the table below.

OPEN TYPE A. C. MOTORS



40°C rated, in applications seldom reaching or exceeding this temperature.

for THIS LOAD	*use* THIS RATING	*instead of* THIS RATING	*save these* MATERIALS
hp	hp	hp	lbs.
1.25	1.	1.5	36
1.88	1.5	2.	14
3.75	3.	5.	19
6.25	5.	7.5	63
9.38	7.5	10.	80
25.0	20.	25.	106
37.5	30.	40.	186
62.5	50.	60.	320
125.	100.	125.	550



STANDARD WESTINGHOUSE MOTORS ARE GENERALLY AVAILABLE FOR PROMPT DELIVERY FOR WAR JOBS

Motors and Control

WESTINGHOUSE

Modern Lighting

LIGHTING AN AIRCRAFT PLANT

With American industry going all-out for production, the factor of time becomes one of signal significance. Machines are made of metals, chemicals and time. And light can help to save minutes by making details more easily seen. Light and time really operate as though they are on either ends of a teeter board. As the foot-candles go up the time required to see goes down. This means more production. Conversely, as

***AVIATION PRODUCTION** under 30 foot-candles provided by two lamp RF units on 10- by 15-foot centers.*

the foot-candles go down, the time required to see goes up and this means less production.

Making every minute count, plane manufacturers are giving their employees the benefit of good lighting. This installation of two-lamp RF units on 10- by 15-foot centers, mounted 13½ feet high, provides 30 foot-candles.

LIGHT MAKES SHOPPING EASIER

With war calling more and more men to the colors, light assumes an important role in the business of merchandising. Among the benefits of good lighting are

***CONTINUOUS ROWS** of recessed fluorescent units provide 65 foot-candles in this store.*

those of speedier sales and fewer returns. These direct benefits mean that present merchandising personnel can carry on much more effectively than would otherwise be the case.

An excellent example of "sales speeding light" is Flah and Company, Inc., Syracuse, New York. The installation consists of continuous rows of recessed units each equipped with 2 rows of the 40-watt white fluorescent lamps. The units, which are of Gruber Brothers make, are equipped with Holophane Controlens. There are 65 foot-candles provided. The white fluorescent lamps are also employed over the wall cases in equipment made by the Grand Rapids Store Equipment Company.

A PRIVATE OFFICE

The seeing tasks performed in private offices are generally not regarded as critical because the work, whether it be reading or writing, is generally done intermittently, between telephone calls, conferences, etc. The foot-candles recommended fall into the C + classification or about 30.

There is plenty of latitude in the type of lighting to be recommended for these

***FLUSH TROFFER** on 6- by 7-foot spacing provide attractive yet efficient lighting in a machine tool plant office.*

***TROFFER LIGHTING**—The Austin Company of Cleveland, Ohio, internationally known builders, have recently added to their home office space. This new addition is 70 by 80 feet. A tapered ceiling is employed, tapering from 27 feet at the center to 16 feet at the sides. The lighting in this area is provided by Miller 2-light 48 inch troffers recessed in the plaster ceiling. These are 16 feet in length and providing lighting of the order of 35 to 40 foot-candles.*

— Speedy Ways to MORE WAR PRODUCTION - Quicker

BALANCED LIGHTING *for* BETTER SEEING ON THE JOB

INDUSTRIAL fostoria SERVICE

INFRA-RED PROCESS *for* BETTER BAKING AND DRYING

Keeps Worker's EFFICIENCY HIGH

Quick, accurate, comfortable "seeing" is your workmen's most vital tool. On the efficiency of their eyes depends the speed and quality of their production.

For maximum eye efficiency the worker needs Balanced Lighting—Localites for high intensity illumination directed on his job — Generalites for horizontal illumination of the working area background.

As in the shell case machining operation pictured above, and for thousands of machine, assembly and inspection jobs. Fostoria Balanced Lighting is speeding war production—giving workmen the high "seeing" efficiency so vital to do their jobs with greater quickness, accuracy and minimum fatigue.

Keeps Production MOVING FASTER

Minutes instead of hours for the drying of paint on airplane engines. As pictured above, one spray coat and two spray finish coats are now baked at once in only 5 minutes.

Today, many operations of baking, drying, dehydrating and preheating are being greatly speeded and improved by the amazing Infra-Red Process.

Quickly available Fostoria Para-Sphere equipment provides the approved means to utilize this modern method for war production. And Fostoria Industrial Service provides the technical and testing service to adapt the process to individual industry requirements. Request full information, today.

THE FOSTORIA PRESSED STEEL CORPORATION, FOSTORIA, OHIO

Fostoria Products Manufactured and Distributed in Canada by Amalgamated Electric Corp., Ltd., Toronto, Canada

CALL OR WRITE YOUR NEAREST FOSTORIA INDUSTRIAL SERVICE STATION

For Counsel on Lighting and Drying Problems

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299 Techwood Dr., N.W. Phone: Jackson 1695

BALA-CYNWYD, PA.
The J. V. Calhoun Company
349 Montgomery Ave.
Phone: Greenwood 4477 at Phila.

BIRMINGHAM, ALA.
National Distributors, Inc.
1925 Fifth Ave., N. Phone: 3-6259, 3-6250

BOSTON, MASS.
Fostoria Engineering Service
(Div. of Copley Sales Co.)
620 Commonwealth Ave., Phone: Com. 0333

BRIDGEPORT, CONN.
Sprague Electrical Supplies, Inc.
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Fostoria Industrial Service
(Div. of Wipperman & Mitchell, Inc.)
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CHARLESTON, W. VA.
Charleston Electrical Supply Company
Phone: 26-157

CHARLOTTE, N. C.
Mill Power Supply Company
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Court & Race Sts. Phone: Parkway 2080

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Electric Power Equipment Company
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The Folsom Company
509 Elm St.....Phone: Riverside 9803

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2615 12th St. Phone: Cadillac 0043-44

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FT. WAYNE, IND.
National Mill Supply Company
207 E. Columbia St Phone: Anthony 2331

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Electrical Supplies, Inc.
320 Ann St.... Phone: 7-7111

INDIANAPOLIS, IND.
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Fostoria Industrial Service
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3690 Santa Fe Ave.... Phone: Jef 6294
Fostoria Industrial Engineering Service
(Div. of Quality Electric Co., Ltd.)
1235 E. Olympic Blvd.... Phone: Trin. 5981
Fostoria Industrial Service
(Div. of Leo J. Meyberg Co.)
2027 S. Figueroa St..... Phone: Pr. 6011

LOUISVILLE, KY.
Pickrell & Craig, Inc.
209 E. Main St. Phone: Jackson 5331

MILWAUKEE, WISC.
Fostoria Engineering Service
104 E. Mason St. ... Phone: Daly 2949

MINNEAPOLIS, MINN.
Fostoria Industrial Service
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Electric Appliance Company
500 Camp St. Phone: Raymond 7151

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Fostoria Industrial Service of N. Y.
92 Warren Street Phone: Worth 2-3352

NORFOLK, VA.
Fluorescent Light Company, Inc.
857-65 West 44th St. ... Phone: 38092

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Fostoria Industrial Service
(Div. of Pacific Electric Motor Company)
10th & Oak Sts. Phone: Glencourt 1844

OMAHA, NEBR.
Fostoria Industrial Service
1107 Farnam St. ..... Phone: AT. 5540

PITTSBURGH, PA.
Fostoria Industrial Service
7133 Frankstown Ave.....Phone: Fr. 0100

PHILADELPHIA, PA.
(see Bala-Cynwyd)

PORTLAND, OREGON
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207 N. W. 14th St..... Phone: Atwater 7233

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1706 Olive St..... Phone: Central 0153

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SPOKANE, WASH.
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63 Ways
TO USE AUTOMATIC TIMERS

Yes... Z SERIES

PARAGON AUTOMATIC TIMERS are being used in 63 ways—and more—in manufacturing and plant maintenance to save time and boost total production. For instance, in such jobs as plastic molding, rubber curing, heat treating, enamel baking, liquid agitation, light exposure, pump operation, conveyor operation, watchman signals, power disconnect, and innumerable other operations.

Every Paragon unit is precision-built, simple, accurate, rugged, reliable, modern, and reasonably priced. Made by an organization of designers and engineers, growing since 1905.

WRITE FOR THIS BOOK

A complete catalog describing industrial timers, time switches and other time control devices. Contains illustrations, construction and installation data, list prices and valuable reference information. Sent without cost or obligation. To avoid delays, please furnish with timer orders a preference rating of A-10 or better.

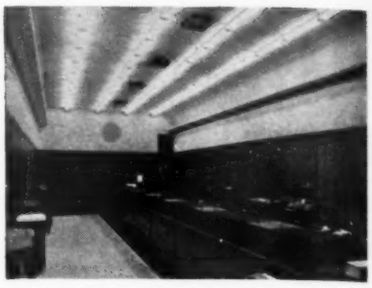
PARAGON ELECTRIC CO.
401 So. Dearborn St., Chicago, Ill.

Paragon
BUILDERS OF CONTROL INSTRUMENTS SINCE 1905
Chicago

Modern Lighting

[FROM PAGE 78]

areas. An installation in one of the private offices at Monarch Machine Tool Company, Sydney, Ohio employs the troffer principle. Two lamp units are used with the troffers on 6- by 7-foot spacings. They are equipped with the 40-watt white lamps to provide 35 foot-candles in service. It will be noted that the troffers are placed so that there is a unit directly above any location where seeing may be done.



THE CITIZENS SAVING AND LOAN ASSOCIATION at Dayton, Ohio, are employing 4 rows of continuous surface-mounted luminaires equipped with 40-watt white lamps and are receiving 50 foot-candles throughout the entire work area.

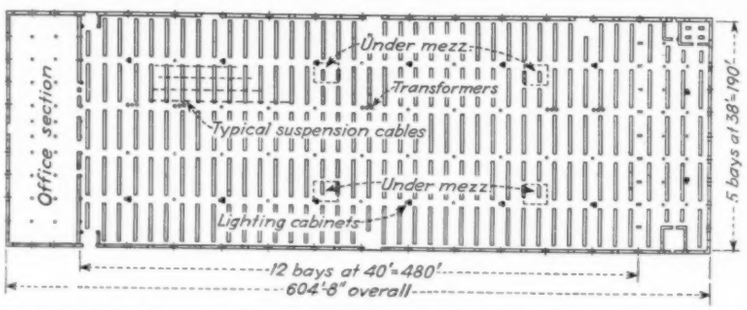
Lighting a LARGE FACTORY BUILDING

PROBLEM—To provide a large factory area with the best possible high-level general illumination suitable for performing precision manufacturing work efficiently, economically and comfortably.

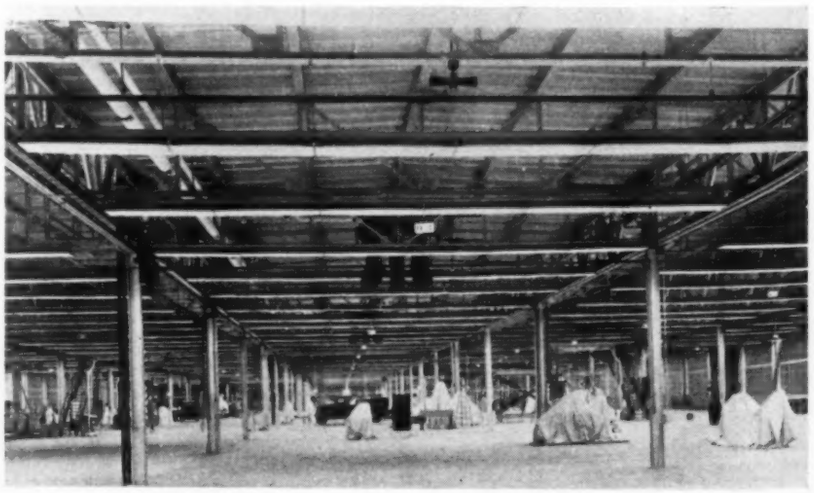
CONSTRUCTION DATA—The factory manufacturing floor is 480 feet long and 190 feet wide, consisting of 60 bays measuring 40 by 38 feet each.

SOLUTION OF PROBLEM — General illumination is provided in each bay by three continuous rows of two-lamp reflectors on 13-ft. 4-in. spacing, each row consisting of six RLM fluorescent open porcelain-enamel steel reflectors. Each reflector is equipped with two 100-watt mazda F (fluorescent) lamps. The reflectors are hung on guy wires at mounting heights of 15½ feet from the floors and are switched on at each bay with circuit breaker switches in the steel columns. Each bay (40-ft. by 38-ft.) has a total of 36 mazda F lamps, which with the auxiliaries consume a total of 4230 watts.

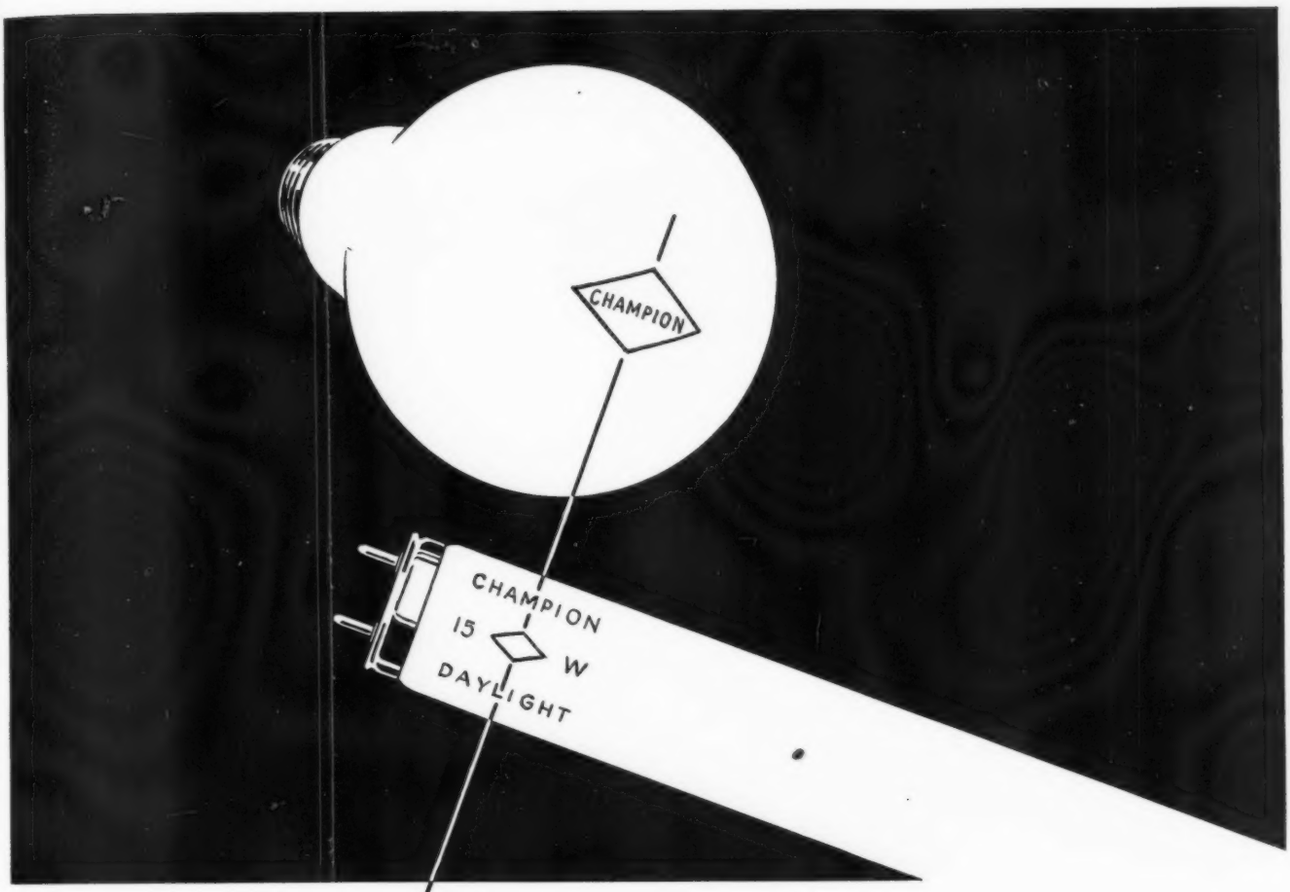
RESULTS—The average general illumination provided is between 50 and 60 foot-candles in service.



LAYOUT PLAN of a factory area showing the arrangement and spacing of continuous reflector made up of five foot sections.



FIVE FOOT reflector sections in continuous rows 13 feet 4 inches apart are equipped with two 100-watt fluorescent lamps in each to light this factory.



Diamonds
FOR INDUSTRY

Like the industrial diamond the *Champion Diamond* mark on your Fluorescent and Incandescent Lamps is a symbol of utility that is of real significance to the Nation's great production effort. On lamps, the Champion Diamond signifies not only high value but low cost. Since 1900 the Champion organization has devoted its entire technical and productive resources, skill and experience to a single purpose—that there shall be no better lamp than Champion.

Right now, good, dependable light is more important than ever.

There is a dependable industrial supplier of Champion Lamps in your neighborhood.

Champion Lamps are licensed under General Electric Co. incandescent and fluorescent lamp patents.

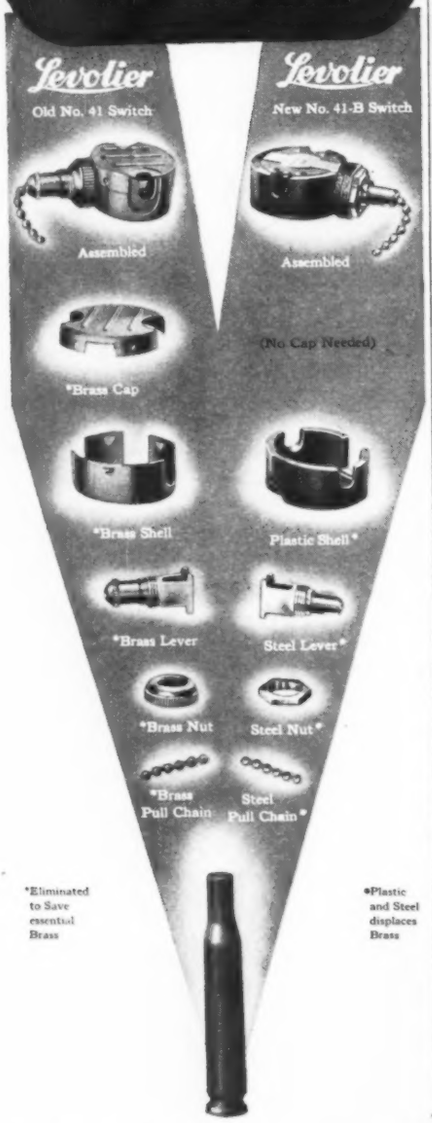
CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.

SAVES BRASS

FOR

3,800,000

.30 CALIBER SHELLS



In eliminating brass from McGILL Levolier No. 41-B Switch, enough critical material has been released to make 3,800,000 of .30 caliber shells. In place of the brass used a plastic casing has been developed with steel lever, nut and chain, making a sturdy unit, light in weight, easy to wire. Elimination of casing-cap facilitates assembly of switch. Ask for folder.

ELECTRICAL DIVISION

McGILL MANUFACTURING COMPANY, INC. VALPARAISO, INDIANA

Modern Lighting

[FROM PAGE 80]

ALL-STEEL EQUIPMENT COMPANY

This Aurora, Illinois concern wanted to be sure that adequate, well diffused illumination was provided for the most difficult seeing tasks performed in their office area. The area was used for general clerical work and also for drafting. Grade B illumination is required for drafting and consequently, the installation was designed for 50 foot-candles. This is provided by Mazda F lamps in recessed, louvered troffers placed on 5-foot centers. In the background is a 55-foot photomural tracing the evolution of All-Steel products. To the men facing this windowless end wall, it seems to give a feeling of space.

***HIGH LEVEL** fluorescent lighting in flush ceiling troffers provides excellent illumination for this area.*

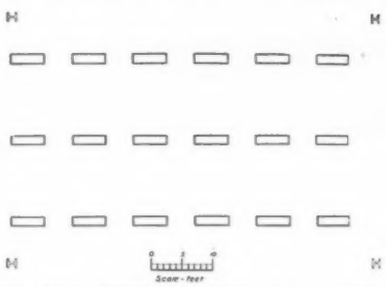
Lighting a DEFENSE MACHINE SHOP

PROBLEM—To provide high visibility for all types of machine tools from the general lighting installation.

CONSTRUCTION DATA—The area lighted is 1020 by 200 feet, with a monitor ceiling. The walls and ceiling are finished in flat white and the floors are oiled wood block. This plant is engaged in manufacturing machine guns.

SOLUTION OF PROBLEM—The general illumination is provided by individual porcelain-enamel steel reflectors, each equipped with two 100-watt, 60-inch white Mazda F lamps. The reflectors are spaced on 10-ft. by 13-ft. 4-in. centers and mounted 15 feet above the floor.

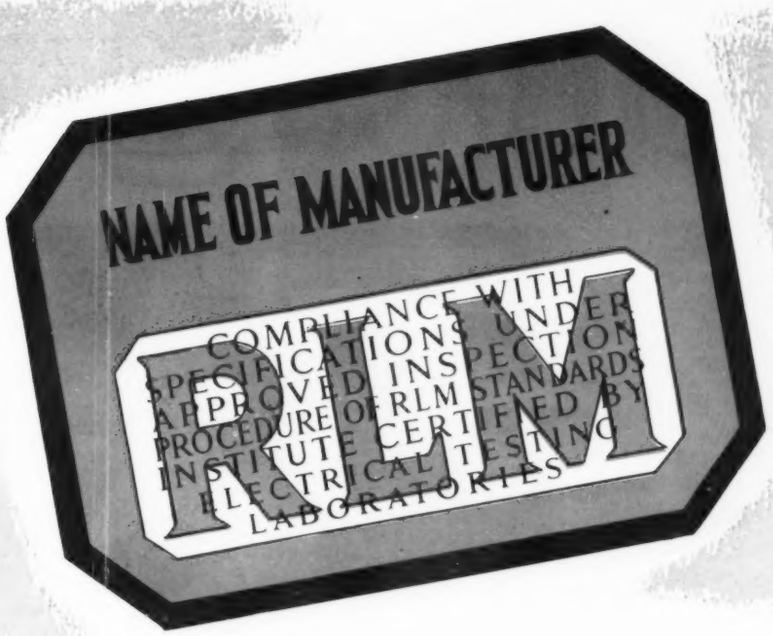
Power is supplied to each reflector by means of a flexible cord extending from the reflector to a conduit outlet on the ceiling. There are 1557 reflectors in the whole installation and they incorporate Tulamp ballasts which have essentially unity power factor and which minimize stroboscopic effect.



LAYOUT SCHEME—A partial plan showing the location and spacing of the lighting units.

RESULTS—The average horizontal illumination provided is 35 foot-candles in service at the working level.

***TWIN 100-WATT** fluorescent lighting fixtures suspended on 10 by 13 feet, 4-inch centers, 15 feet above the floor provide high visibility in this machine shop.*



Will RLM Certified Fluorescent Lighting Units Be Available With Non-Metallic Reflectors?

Recognizing the importance of adequate lighting in round-the-clock production of vital war products, the WPB is still permitting limited production of Industrial Fluorescent Lighting Units with RLM certified steel reflectors.

The need for steel and still more steel for ships, tanks, guns and other combat equipment is so great that manufacturers of RLM fluorescent equipment have been working with the WPB and the Bureau of Standards in the development of a satisfactory non-metallic reflector.

Such non-metallic reflectors are in production and can be supplied by the manufacturers of RLM fluorescent units. However, for the present these units do not carry the RLM LABEL. Provisional specifications have been prepared and upon completion of the laboratory tests being conducted by the independent testing laboratories, RLM manufacturers will be authorized to supply non-metallic reflectors with RLM certified fluorescent industrial units.

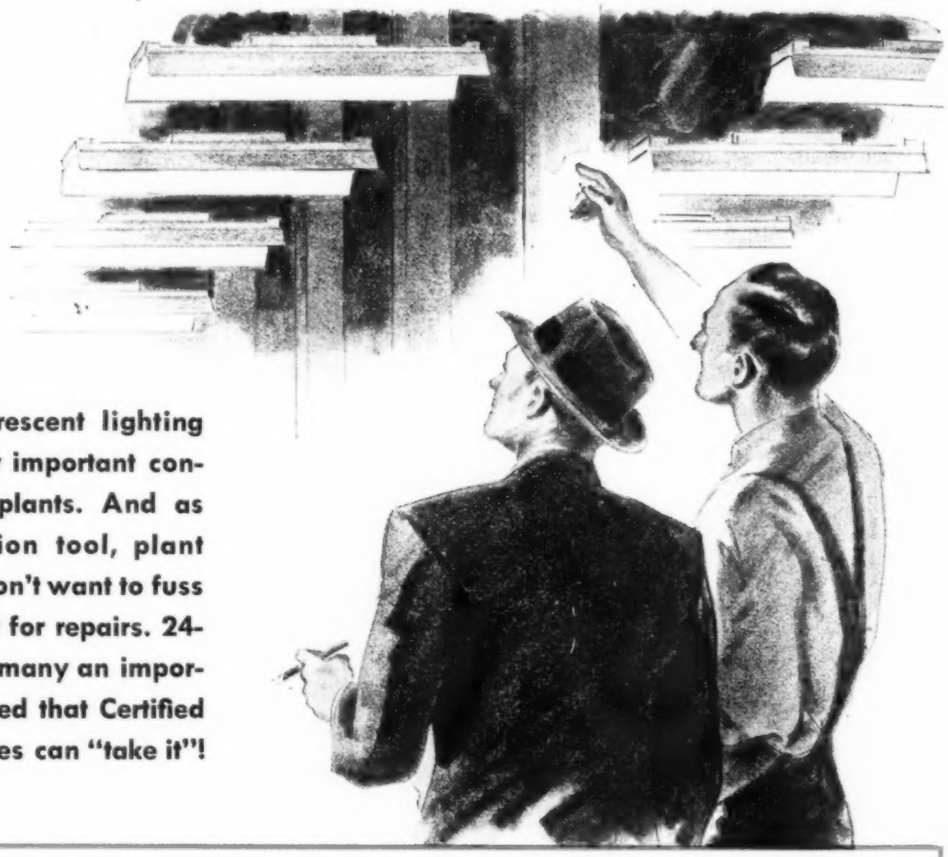
Complete RLM specifications, which will be made available as soon as laboratory tests are completed, may be secured by writing any manufacturer of RLM Industrial Fluorescent Lighting Units or the RLM Standards Institute.

The Letters RLM Stand for Reflector and Lighting Equipment Manufacturers

★ ★ ★ RLM STANDARDS INSTITUTE INCORPORATED ★ ★ ★

307 N. MICHIGAN AVE. SUITE 1600 · CHICAGO, ILL.

FLEUR-O-LIERS



The matter of fluorescent lighting fixtures is a mighty important consideration in war plants. And as with any production tool, plant maintenance men don't want to fuss with costly time out for repairs. 24-hours-a-day use in many an important plant has proved that Certified FLEUR-O-LIER fixtures can "take it"!

DEPENDABILITY COUNTS!

See why it pays to specify FLEUR-O-LIERS

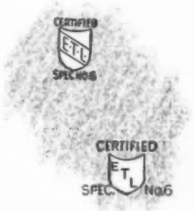
- **Certified starters and ballasts** . . . assuring balanced operation —high power factor.
- **Durability and Safety** . . . electrically and structurally sound.
- **Ease of Maintenance** . . . easy to clean and re-lamp.
- **Maximum light output** . . . Certified control equipment plus high reflection factor assures efficient light from the lamps.
- **Flicker correction** . . . on circuits of two lamps or more.
- **Correct ventilation** . . . no danger of overheating in control unit.
- Every unit carries the FLEUR-O-LIER Manufacturers' Guarantee.

set new Standards of
PERFORMANCE AND SERVICE

Fixtures bearing this FLEUR-O-LIER label assure your customers maximum use of their lamps—plus electrical and mechanical dependability. That's important these days when every minute counts—and equipment must stand up!

And here's the reason. Though nearly 50 independent fixture manufacturers make FLEUR-O-LIERS, they all make them to 50 definite specifications set up by the makers of Mazda lamps. And FLEUR-O-LIERS meet these specifications as tested and certified by impartial Electrical Testing Laboratories.

Important: Ballasts and starters have more to do with the satisfactory performance of fluorescent lamps than any other part of the fixture. Because *every* FLEUR-O-LIER fixture has Certified ballasts and starters, you can assure your customers of these advantages: longer lamp life—greater lighting efficiency—full use of the wiring system through high power factor ballasts—long life and dependable service from the units themselves!



A vital tool in wartime production, fluorescent fixtures now require a suitable WPB priority rating. Any of the FLEUR-O-LIER Manufacturers will be glad to work with you on this to get the best lighting possible. Fleur-O-Lier Manufacturers, 2122-9 Keith Building, Cleveland, Ohio.

FLEUR·O·LIERS

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements.

Estimating

Figuring Trench Excavations

Electrical contractors are frequently required to estimate trench excavations and concrete envelopes for underground duct runs. Here is a table that takes the guesswork out of such estimates and reduces calculations to a simple multiplication of two quantities.

By Ralph H. Decker *Consulting Electrical Engineer, Chicago, Ill.*

EVERY electrical contractor has, at one time or another, been called on to estimate underground conduit runs of various types. This, of course, involves estimating trench excavations and concrete pours for the enclosing envelope—where such is required. Not infrequently this portion of the estimate revolves into simple guesswork—unless the estimator has both the time and inclination to sit down and painstakingly calculate the cubic yards of excavation and concrete necessary to do the job. This is an arduous task and some estimators prefer to save time and take a gamble on this portion of the estimate.

However, if an estimate is to be an accurate record of probable costs, it should be consistently accurate throughout. A little guesswork here and there frequently proves disastrous—either by losing the job or losing money if the bid is low. On some jobs, underground runs form a sizable portion of the work and one can go haywire very easily unless accurate calculations are made.

Through years of experience I have found it profitable, from the standpoint of time and expense, to discount all guesswork in estimating. Hence, the development of the following table for calculating trench excavations and concrete fill.

The table is based on the use of 4-in. Transite "Korduct" conduit embedded in a 3-in. concrete envelope with a 1-in. separation between ducts. These dimensions are quite standard and average for a majority of underground work. The table (Chart 2) is based on conduit groups of 1, 2, 3, 4, 6, 9, 12 and 16 as shown in Chart 1.

Columns 1, 2, 3, 4 and 5 give pertinent data on areas of conduits and the concrete block for various duct groupings. Column 6 gives the net area of the concrete block (total area of the block less the total areas of the ducts). Column 7 gives the yards (cu. yds.) of concrete per foot of trench necessary to provide the envelope around various duct formations. Column 9 gives the yards (cu. yds.) of excavation per foot of trench, based on calculations from the size of the trench listed in column 8 to the left.

Now, how can the table be used. To best illustrate this let's take a typical example.

Problem—How much excavation and concrete are necessary to install nine, 4-in. ducts with a 3-in. concrete envelope in a 250-ft. trench.

Solution—Under column 1 find the figure 9. Go horizontally across to column 9 and find the quantity 0.346 (yds. excavation per trench ft.)

Then: Yds. Excavation = Yds. Excavation per trench foot × length of trench in feet

Yds. Excavation = 0.346 × 250 = 86.5

Go horizontally across under 9 in column 1 to column 7 and find the quantity 0.08270 (yds. of concrete per trench ft.)

Then: Yds. Concrete = Yds. Concrete per trench ft. × length of trench in ft.

Yds. Concrete = 0.08270 × 250
= 20.675

Thus, the simple multiplication of the quantities in columns 7 and 9 by the length of the trench (in feet) gives the answer. Without these units it would be necessary to go through the tedious task of determining the cubic yards of earth in the trench of the size needed; and to determine the concrete would require calculating the total cubic area of the concrete block and subtracting the total cubic area of the ducts.

Once the amount of excavation and concrete are determined, labor units and concrete costs can be applied. The labor units for excavation will vary

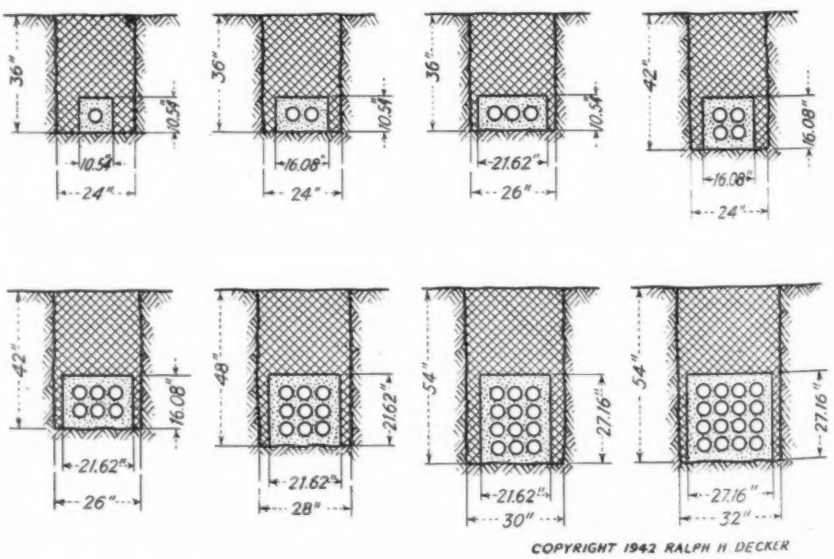


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***CHART 1—DUCT FORMATIONS** showing the dimensions of the trench and concrete envelopes, based on using 4-in. Transite "Korduct" conduit embedded in a 3-in. envelope with 1-in. separation between ducts.*

Save Rubber and Copper... assure lasting trouble-free power distribution with Okonite V. C. Cables

For power wiring, you can't afford to overlook these timely advantages of Okonite V. C. Cable

REQUIRES NO RUBBER – SAVES COPPER
Insulated with varnished cambric instead of rubber, Okonite V. C. cable not only saves this precious material, but copper, too, can be saved as the higher heat resistance of varnished cambric makes it possible to use a smaller conductor to carry the same load.

EASY INSTALLATIONS
Okonite V. C. cable is fast and simple to splice, requires no special tools or methods. It handles easily.

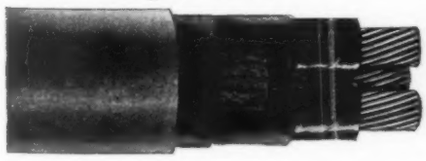
OUTSTANDING SERVICE RECORDS
Under all sorts of operating conditions and over long periods of time, Okonite V. C. cable has set records for trouble-free, lasting service.

FOR JOBS UP TO 28,000 VOLTS
Okonite V. C. cable is made in a complete range of sizes up to and including 28,000 volts. What's more, you can order it with various types of protective coverings to meet particular requirements best.

For complete information on Okonite V. C. cable or for help with any insulated wire or cable problem, call on our experienced engineers. They are ready to assist anytime without obligation to submit designs and estimates.

Meets all current IPCEA and Marine Specifications

THE OKONITE COMPANY
Passaic, New Jersey
Offices in Principal Cities



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INSULATED WIRES AND CABLES

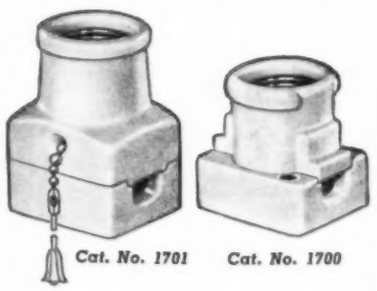
P&S
WIRING DEVICES

NOW being used on defense projects throughout the country

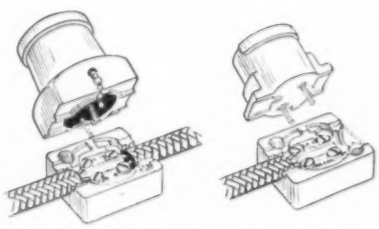
TWO NEW WIRING DEVICES

Designed especially for today's market — PORCELAIN CABLETTES. Easy to wire and assemble. No boxes, clamps, connectors or soldering — Installed directly on the surface.

SIMPLE TWO-PIECE DESIGN



Cat. No. 1701 Cat. No. 1700



Conserve Critical materials—Get the job done quickly without sacrificing quality.

WIRE TODAY THE P&S WAY

Send for complete information regarding P&S Wiring Devices for the 1942 market.

SOLD THROUGH ELECTRICAL WHOLESALERS

Pass & Seymour, Inc.
SYRACUSE, N. Y.

UNDERGROUND CONSTRUCTION DATA

No. of ducts 1	Size of ducts 2	Duct Area Sq. In. 3	Size of Concrete Block 4	Area of Block-Sq.In. 5	Net Area of Block-Sq.In. 6	Yds. Concrete Trench Ft. 7	Size of Trench 8	Yds. Excavation Trench Ft. 9
1	4"	16.20	10.54"x 10.54"	111.10	94.90	0.02440	24"x 36"	0.222
2	4"	32.40	16.08"x 10.54"	169.50	137.10	0.03523	24"x 36"	0.222
3	4"	48.60	21.62"x 10.54"	228.00	179.30	0.04610	26"x 36"	0.241
4	4"	64.80	16.08"x 16.08"	257.60	192.80	0.04960	24"x 42"	0.260
6	4"	97.13	21.62"x 16.08"	347.60	250.50	0.06440	26"x 42"	0.280
9	4"	145.69	21.62"x 21.62"	467.40	321.70	0.08270	28 x 48"	0.346
12	4"	194.26	21.62"x 27.16"	587.20	392.90	0.10105	30"x 54"	0.417
16	4"	259.01	27.16"x 27.16"	737.66	478.65	0.12310	32"x 54"	0.444

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CHART 2—TRENCH DATA compiled from Chart 1 duct formations. Values in Columns 7 and 9, when multiplied by the length of the trench (in feet) will give the yards of concrete and trench excavations, respectively, for various duct groups.

with the type of earth encountered—sand, gravel, dirt, stones, clay, etc. It is important to know the ground conditions before applying these labor units. The cost of concrete will undoubtedly vary with the type of mixture, quantity, nearness of a concrete mixer to the job, and whether it is a job-mix or transit-mix.

Intelligent use of the above table should help increase the speed and accuracy of underground estimates.

ESTIMATING GUIDES

—*Lighting Fixtures*

What should we look for when taking off lighting fixtures? The answer will be found in this the seventh item of the "Estimating Guides" series which reviews good estimating practice.

From a monetary standpoint lighting fixtures, especially the fluorescent type, are becoming a larger and larger part of the modern lighting system. Errors or omissions in fixture take-off mean money lost and, especially under present conditions, may mean difficulty in securing the additional units needed to complete the job.

Good practice demands that lighting fixtures should be taken-off and listed as an entirely separate item of the estimate. Accuracy in fixture take-off can be obtained by:

1. Taking the fixtures off separately and using the original outlet count as a check.
2. Study the plans and specifications for special fixtures such as:
   - (a) Cove lighting
   - (b) Window lighting
   - (c) Range hoods
   - (d) Spotlights
   - (e) Floodlights
   - (f) Yard lights
   - (g) Roof lights
   - (h) Fence lights
   - (i) Localized lighting units
3. Check for varying ceiling heights.
4. Check specifications for fixture allowances.
5. After all of the fixtures have been listed on the pricing sheets, check to see that none of the following have been overlooked:
   - (a) Lamps (size, color and types)
   - (b) Stems and wires
   - (c) Aligners
   - (d) Special supports
   - (e) Lowering devices
   - (f) Switches (canopy and pull)
   - (g) Auxiliary devices
   - (h) Explosion-proof equipment
   - (i) Tubs for flush units
   - (j) Glass for flush units
   - (k) Extension nipples and studs
   - (l) Glass, plastic or metal enclosures and louvers for surface mounted units
6. Check carefully to see if fixtures are shipped wired or unwired, partially assembled or completely unassembled.
7. Check all pricing and extensions.
8. Establish an appropriate price per fixture for both labor and material to see if results seem reasonable.

Keep the fixture pricing sheet as a separate unit. Do not put anything else on it. Keeping it separately will aid in breaking down the bid if necessary and may also help in establishing unit prices for hanging fixtures. This data is often required on proposals. These separate sheets on fixtures, switchboards, panels, and other equipment can be readily consulted and used when placing orders for these materials.

MAKING MILL SURVEYS

Many medium and small sized mills or shops are finding themselves handicapped in their attempt to get into full swing in war production. This might result from one or two major reasons—inefficiency of tool and other machine operations,

WANT PRODUCTION INCREASED IN A HURRY?

"Well, since Curtis Industrial Lighting Equipment has been installed we have been getting 'day shift' production 24 hours a day.

No. 1507-C

WHERE WE USED INCANDESCENT

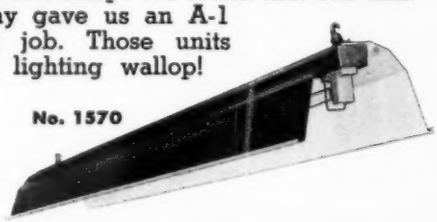
No. 589-T

"In many places we used incandescent lighting. Here, Curtis No. 589-T with 1500 watt lamp was the answer. They are easy to install and maintain, and their Silver Mirrored Glass Reflector provides a first-class, high-intensity directional lighting job. The No. 589-T unit has a special tripod holder with a cast metal ring at the bottom, which protects the reflector.

IN THE REALLY HIGH BAYS OF ANOTHER DEPARTMENT WE USED CURTIS NO. 1570

"This is made for the new 3KW Mercury Mazda AH-9 lamp. We found that one unit to a bay gave us an A-1 lighting job. Those units pack a lighting wallop!

No. 1570



IN THE ASSEMBLY ROOM WE USED THE LATEST NON-METALLIC "FLURATEX" REFLECTORS

"Curtis is right in there helping to conserve metal and has switched from steel to their new chip-proof Non-Metallic reflectors. We find them rigid and they are guaranteed to give first-class performance.

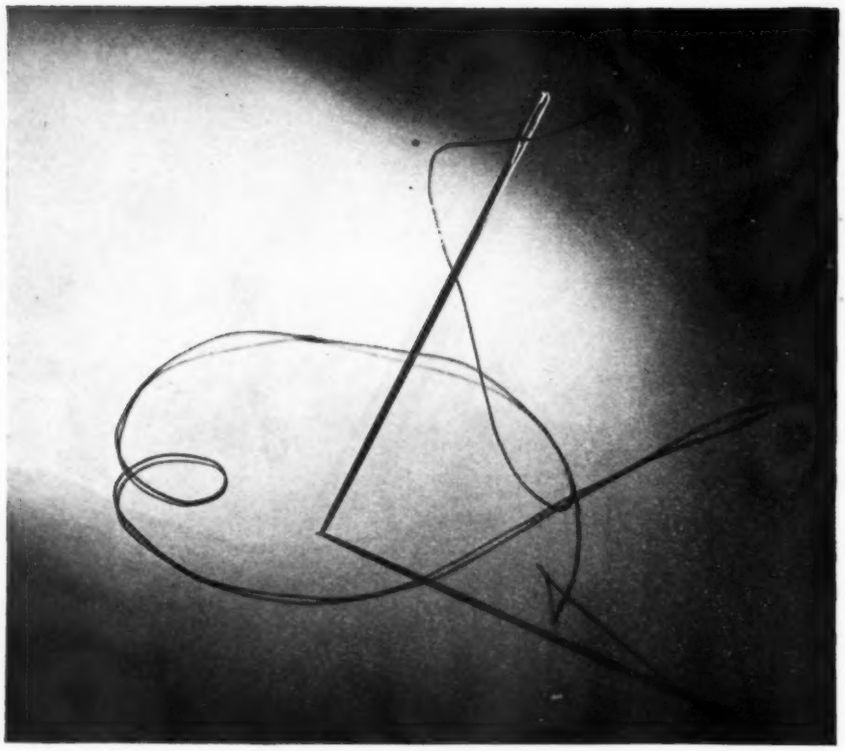
"There are three different types: No. 1506 for two 40 watt fluorescent lamps, No. 1507 for three 40 watt lamps and No. 1508 for two 100 watt lamps.

"Those 'Fluratex' reflectors are finished in Fluracite. This is a baked, synthetic reflecting surface which is glossy white and very tough. Curtis discovered and developed Fluracite, especially for use with fluorescent lamps. We've found that it possesses unusually high reflectivity and is easily cleaned with soap and water, or with any of the common (non-abrasive) cleaning compounds. Curtis has used Fluracite on their fluorescent products for over 3½ years.

"I'm sure the Curtis representative would be happy to help you with your lighting job or if you like, you could write direct to the factory."

CURTIS LIGHTING, INC.

6135 W. 65TH STREET... CHICAGO



THE EYE OF A NEEDLE

In a needle's eye we see a moral for industry. Just as the delicate job of threading a needle goes easier and faster when there is plenty of light, so the delicate jobs of industry are done better and quicker with adequate lighting, properly placed. You can count on Silv-A-King equipment to give you plenty of light, and on Silv-A-King's 21 years of experience for proper layout and installation. Silv-A-King lighting engineers will be glad to advise you on either fluorescent or incandescent installations.

Bright Light Reflector Company, Inc.,
1033 Metropolitan Avenue, Brooklyn, N. Y.

Write for new, 16-page Silv-A-King book:
"Light Is An Essential Production Tool"

A Few Typical Silv-A-King Users:
AC SPARK PLUG
GENERAL MOTORS
FISHER BODY
INTERNATIONAL HARVESTER
JONES & LAUGHLIN STEEL
PITTSBURGH PLATE GLASS
and many others

FLUORESCENT · INCANDESCENT
SILV-A-KING
EQUIPMENT

SILV-A-KING MAKES *Light* WORK FOR YOU

Estimating

[FROM PAGE 88]

possibly due to inadequate wiring; and poor seeing conditions, due to inadequate lighting equipment and the condition of surroundings.

The Northern California Electrical Bureau, San Francisco, offers its contractors the following simple and inexpensive suggestions for surveying these plants to correct such handicaps.

The first step is to make a survey of each plant in question, listing the following pertinent data:

1. The name of the plant.
2. The nature of the work being done.
3. The urgency of their production.
4. The manpower of the shop.
5. The working shifts.
6. The machine load.
7. The present feeder capacity.
8. The style or type of lighting.
9. Condition of walls and ceilings.

Once the survey data has been gathered on a number of cases, it should be classified into different groups. Experience has proved that a large portion of this type of shop or mill easily falls into a relatively few classes.

Classification of the type suggested will facilitate the making of recommendations for better effectiveness of the electrical system.

Recommendations that might be made to increase the usefulness of the lighting system would include the following:

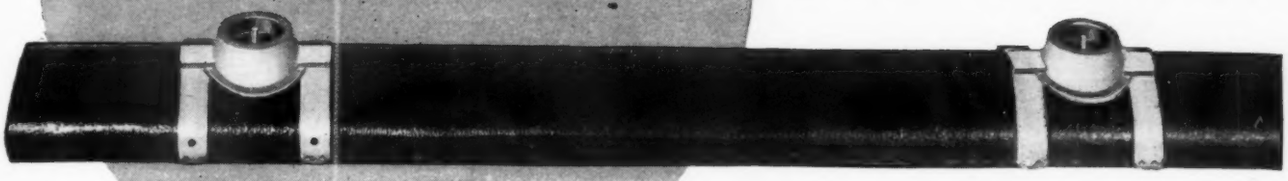
1. Elimination of glare.
2. Proper cleaning and maintenance of fixtures.
3. Proper maintenance of surrounding areas, making sure such areas do not absorb too much light.
4. Possible rearrangement of lighting fixtures in relation to the work.
5. Elimination of sharp and dangerous shadows.

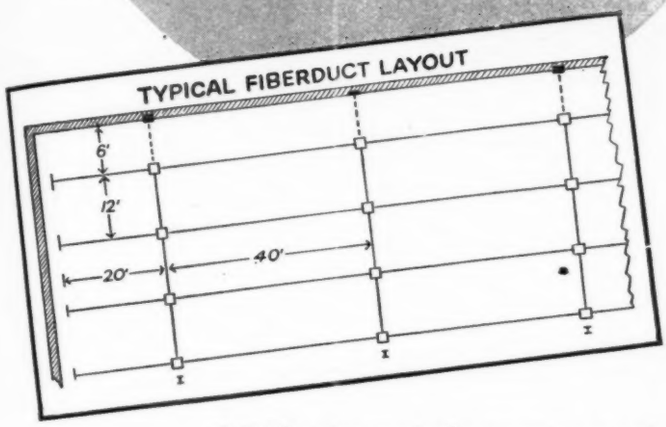
Also, with respect to the power system, the following suggested recommendations apply:

1. Conventional maintenance of motors and equipment taking into consideration dust, oil, moisture, vibration, alignment and actual load conditions.
2. Larger feeders or redistribution of load where overloaded circuits exist.
3. Elimination of overload conditions.
4. Running motors at rated load to help power factor conditions.
5. Use of capacitors where power factor needs to be raised when other means have failed to produce results.
6. Ample capacity of the system to deliver rated voltage at the outlet.

The additional information regarding manpower, production, etc., might easily be used to substantiate requests for priority ratings on the materials needed.

INSTALL G-E FIBERDUCT





FOR *Underfloor* POWER DISTRIBUTION

G-E Fiberduct underfloor raceways make power conveniently available wherever they are installed. Fiberduct systems will aid war production. Machines can be moved. Whole production lines can be rearranged for better efficiency. Your customers will like G-E Fiberduct underfloor power distribution.

OUTLETS WHERE NEEDED

Outlets can be installed anywhere along the duct after the duct is installed. Inserts to accommodate outlets are available for presetting at the factory or on the job and for "after setting" at some later time.

LONG LIFE

G-E Fiberduct can be used to carry lighting circuits, telephone lines or signal systems as well as power lines. It is made of non-corrodible, impregnated fiber and is moisture-resistant and high in mechanical strength. Long service is assured. G-E Fiberduct is available in two sizes with 3 sq. in. and 5 sq. in. areas respectively. Wall thickness of ducts is $\frac{3}{16}$ in. The interior of the duct is smooth so that wire pulling will be easy.

For further information see the nearest G-E Merchandise Distributor or mail the coupon for a catalog.

GENERAL ELECTRIC

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

General Electric Co.
Section C921-8
Appliance and Merchandise Dept.
Bridgeport, Conn.

Sirs: Please send me the G-E Fiberduct catalog.

Name .....

Address .....

City ..... State .....

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

EQUIPMENT NEWS

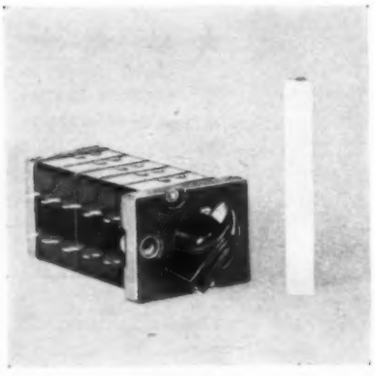
Air Raid Alarm Control

This new air raid alarm control is designed primarily for private use to supplement general signals. It may be used for bells, horns or sirens, within its rated capacity of 10 amperes single pole and is adaptable to loads of any capacity with the use of a relay. Selector switch at left is normally in alarm position, requiring a momentary contact of trigger switch at right to set control in action. At the end of two minutes the alarm stops. Subsequent operations of trigger switch will not affect the two minute cycle. Device is synchronous motor driven and should motor fail to start it may be operated manually. Standard model provides 29 intermittent signals for alarm during its two minute operating period for use with bells or horns. An "all clear" signal of two minutes steady operation is provided. Tork Clock Company, Mt. Vernon, N. Y.

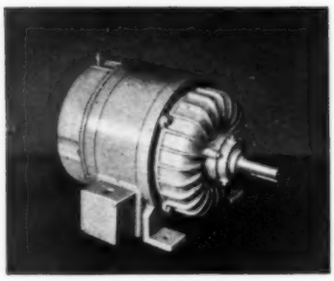
■

Switch

A new multicircuit switch for aircraft service has been announced. It opens, closes or transfers as many as 20 circuits simultaneously by means of a two-position operating knob. Contact mechanisms used are G-E switchettes stacked in pairs. Switchette is snap action, double-break in construction, giving it a high current rating. Switch is available with from 8 to 20 switchettes and in either single circuit or two circuit form. A shaft toggle switch insures positive switch position. General Electric Co., Schenectady, N. Y.



G-E SWITCH



TORQ ELECTRIC MOTOR

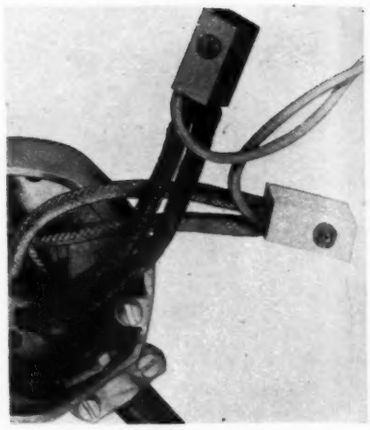
Motor

A new all-enclosed, fan-cooled, polyphase motor known as Type EA. It is recommended for applications where sealed protection is required. Type EA is built in steel and precision sealed against chips, oil and abrasives. Some of the features are totally enclosed, fan-cooled, ball bearings, welded steel stator frame, winding, ground shaft, dynamically balanced and all welded rotor. Disassembly of Type EA motor is quick and easy. The Torq Electric Manufacturing Co., 6609 Carnegie Avenue, Cleveland, Ohio.

■

Insulating Varnishes

New types of Bulls-Eye brand of electrical insulating varnishes have been developed. Type G insulating varnish combines the highest elasticity over the maximum range of temperature with high impregnating qualities. It can be used for binding cotton, glass or asbestos fibres or coating tape made of these materials, or of paper. Its adhesion to glass, toughness, flexibility and dielectric strength make it outstanding as a Glasbinder for Fiberglas covered wire, it is claimed. Other types are—Type BF insulating varnish for impregnating coils, motors and transformers and offered both in black and yellow. Type KR is also produced in black and yellow. It can be used for impregnating cloth and on laminated metal sheets which can be fabricated after the application of the varnish. Insulating Varnish Division, William Zinsser & Company, Inc., 516 West 59th Street, New York, N. Y.



SHERMAN FIXTURE CONNECTOR

Fixture Connector

A new improved fixture connector, made entirely of plastic has been announced. Connector is the set-screw type. It is made in two colors—red for hot wire and white for ground. This provides an easy means of identifying connections and is a convenience, especially on old wiring that is not polarized. The plastic material is tough and durable. The body of the connector has been made slightly larger and the Vee-shaped opening for wires has been increased in size. It requires no taping. H. B. Sherman Mfg. Co., Battle Creek, Mich.

■

Emergency Light

The damage control light is a high intensity source of emergency light intended primarily for use by damage control personnel on board ship. Can also be used by fire departments, power companies and industrial plants for lighting of emergency repairs. It is available in three different types. No. 9991 is complete with Navy type storage battery; No. 9992 is for use with six No. 6 dry cells and No. 9993 with adjustable straps is for use with standard storage battery. Some of the features are a lamp head assembly, consisting of lamp housing to which is riveted a channel designed to enable vertical positioning of lamp; an "on-off" switch; a sealed-beam lamp, Navy Type SB-1; and a cover and attached bracket for holding lamp housing and handle. The F. W. Wakefield Brass Company, Vermilion, Ohio.

WAKEFIELD EMERGENCY LIGHT

TAPES

That Save Vital Metal and are Easily Worked

PANTHER & DRAGON

1. First to be Wrapped and Sealed in Cellophane
2. Perfect Adhesiveness and Tensile Strength
3. Strong, Durable Core
4. Colorful Attractive Boxes
5. A Company in the Insulation Business Since 1878

Sold Exclusively Through Distributing Wholesalers

HAZARD INSULATED WIRE WORKS
DIVISION OF THE OKONITE COMPANY
Wilkes-Barre, Pennsylvania
Offices in Principal Cities

"BUY U. S. WAR BONDS... Every Payday
All Hazard Employees BUY U. S. WAR BONDS"

PANTHER DRAGON
FRICTION AND RUBBER TAPES

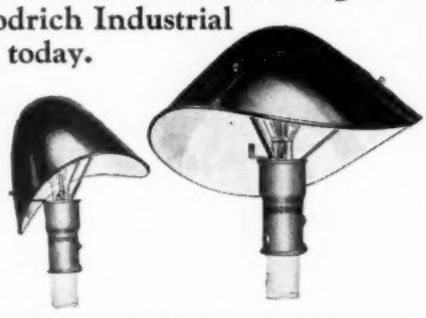
TRAPPED by Light!

There is no getting away from it! To combat the increasing threat of sabotage, properly planned floodlighting installations leave no room for side-stepping. They become "light traps" which prevent approach to vulnerable areas—or escape from them.

Guarding the plants which make America strong is one of the many ways Goodrich Industrial Lighting serves the nation today.

ELIPSO STANDLITE

A typical Goodrich development in lighting. Provides a veritable barrier of light through which intruders cannot penetrate without immediate detection by guards or watchmen. Finished in permanent porcelain enamel and completely weather-proof. Literature on request.



GOODRICH RLM

Protecting vital plants with floodlighting—saving man-hours in production—Goodrich industrial fixtures are serving America's war effort everywhere.

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4602 BELLE PLAINE AVENUE, CHICAGO, ILL.

EQUIPMENT News

[FROM PAGE 92]

Push Button Stations

A new safety pull-push button line of heavy duty interchangeable units has been announced. It uses both the pull and push action. Two operations are performed with one button which cuts in half the number of buttons formerly required. This falls into layout for most control installations, since motors are stopped and started, motions are forward and reverse, up or down, the operations usually being performed in pairs. The button is pushed to stop the motor, but it must be pulled to start. This line includes momentary, 3 position; momentary and maintained, 3 position; and maintained, 2 position, of the pull-push; momentary start of the pull and momentary stop of the push type. The Arrow-Hart & Hegeman Electric Co., 103 Hawthorn St., Hartford, Conn.

A.H.&H. PULL-PUSH BUTTON STATION

■

Blackout Bulb

A new blackout bulb which can be kept burning for emergency lighting without need for window shades or blinds is now ready for use in war plants and government buildings. In war factories, the bulbs will be installed along manufacturing aisles, on stairways and in halls. The blackout lamp is coated with an outer covering of black except for an orange-red opening through which a narrow beam of light passes. The downward direction of this beam prevents any direct rays of light from being seen by planes. Operated at 15 watts, each bulb will provide emergency lighting for an area of approximately 200 square feet. Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

WESTINGHOUSE BLACKOUT BULB

SECURE

DEPENDABLE AND CONVENIENT OPERATION OF PROTECTIVE FLOODLIGHTING WITH *automatic control*

SANGAMO TIME-SWITCHES

Industrial plants engaged in war production need the protection of floodlighting for vital property. Factory yards, railroad sidings, building approaches, substations, transformer banks — all are considered vital property. Sangamo Time-Switches secure greater operating dependability and convenience for floodlighting systems. Contrary to human traits, a Sangamo Time-Switch does not forget to turn lights on or off at the proper time . . . all operations are fully automatic — therefore dependable. Install the time-switch described on this page for protective floodlighting systems.

DURING BLACKOUTS

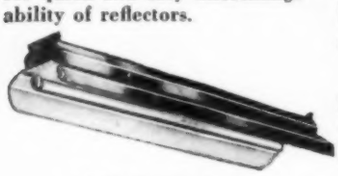
DURING any current interruption, as for instance when a master-switch is pulled for a temporary black-out, Form VSWZ Astronomic Dial Time-Switch will continue to run for ten hours. An automatic carry-over feature provides for clock-spring operation when the current is off. The clock-spring rewinds automatically when the current is restored, and the time-switch resumes its normal synchronous operation.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

Every Shift a "Day Shift" with this "Skilled" Lighting

RLM Duratach Units

Made in Dome, Angle and all other standard types. Wheeler Duratach construction provides for quick and easy interchangeability of reflectors.



RLM Open-End Fluorescent Units

Available in two or three-lamp constructions, units can be mounted from chain, conduit, or directly to ceiling. For use with 48-inch, 40-watt lamps. RLM units for use with 100-watt lamps also available.

Wheeler Installations maintain high-precision lighting levels round-the-clock!

No longer need you count on lower output from your night shifts due to inferior lighting and eyestrain. Modern installations of Wheeler Fixtures give you high-precision "daylight" lighting levels 24 hours a day . . . help to maintain top production with low spoilage on every shift!

Wheeler Lighting is "skilled" lighting, designed to keep skilled eyes working at top efficiency. Developed through 61 years of specialized experience, Wheeler Fixtures apply standard lamps to produce their maximum of useful light per watt. Available in a complete line of industrial types.

Write for catalog of Wheeler Incandescent or Fluorescent Fixtures. **Wheeler Reflector Co., 275 Congress Street, Boston, Mass.** . . . New York . . . Cleveland. Representatives in principal cities.

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881

EQUIPMENT News

[FROM PAGE 94]

Lamp Starter

A new manual-reset fluorescent lamp starter, called the "Master No Blink," which locks dead lamps out of the circuit allowing instant dead lamp replacement, has been announced. With this starter no current flows through the ballast after the dead lamp has been locked out. This current-cut-off feature prolongs the life of the ballast. It also eliminates the "cooling" period. When the starter locks a dead lamp out of circuit, a small red button on top of the starter snaps forward. When the worn-out lamp is removed from the fixture, the red button is pushed in manually to reset the starter. Lamps can be changed without shutting off the current. The starter is available for only 30-, 40- and 100-watt lamps.—General Electric Co., Bridgeport, Conn.

G-E FLUORESCENT LAMP STARTER

■

Fittings

These fittings are molded from Saran, a new thermoplastic and are available for tubing sizes ⅛-in. to ⅜-in. O. D. With these fittings it is possible to set up a complete chemically resistant piping system without the use of any metal. Fittings have a high tensile and bursting strength, are non-corroding and non-aging and being non-conductors of electricity, are able to prevent formation of galvanic couples. Can also be used on metal tubes. Acadia Synthetic Products Division of Western Felt Works, 4115 Ogden Ave., Chicago, Ill.

ACADIA FITTINGS

SIMPLEST ANSWER TO POWER PROBLEMS

Today's race against time demands modern bus duct systems . . . built for mass production . . . engineered to save installation and maintenance time . . . designed for quick production changes

Within a few brief months, the *impossible* has become *routine* in American industry. There is reason for pride—and hope—in that fact. But how has it been accomplished? By multiplying hours of work. By developing new and better methods. By short-cutting every step of every job. By finding simple answers to *complex* problems.

Distribution of power and light to machine tools was one of those problems—complex because of the vast size of modern war plants, because of constant changes in production set-ups, because of the urgent call for *speed, speed, speed!*

Yet there was a simple and easy answer to this problem — BullDog Plug-In Bus Duct Systems, which today are serving hundreds of key plants in which this war production miracle is being accomplished.

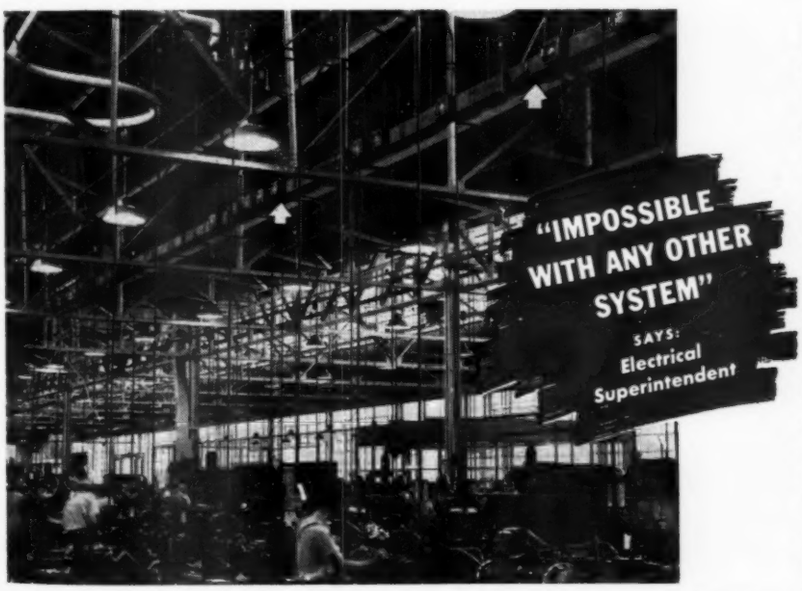
Simple to Build—Install—Convert

BullDog Bus Duct is *simple* in design — speedily manufactured by mass production methods.

BullDog Bus Duct is *simple* to install, follows the roofers down the building. Machines can be plugged in anywhere — and go to work. Days, weeks, even months, of production time are saved.

BullDog Bus Duct is *simple* to convert to any production change —readily moved or extended—and 100% salvable.

A straight line is still the shortest distance between two points. BullDog Systems deliver power and light *direct* to machines at highest efficiency—with a minimum use of war-scarce materials. They are the *simplest* answer to one of industry's most important problems.



The complete installation in this great ordnance plant, one of the largest of its kind in the world, comprises miles of BUStribution DUCT, thousands of protective plugs for plugging in individual machines, and many BullDog switches and panelboards. "It would have been practically impossible," says the Electrical Superintendent, "to distribute power efficiently with any other system."

No other system meets these wartime needs

Power and light *where* they are needed, *when* they are needed.

System can be installed in new plants without waiting for machine layout . . . and machines can go to work as soon as the roof is on.

Tool set-ups can be changed, machines moved, without interrupting light or power.

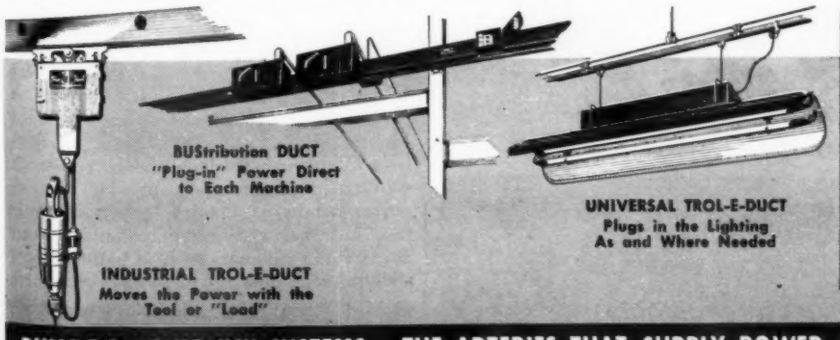
Power operates at higher efficiency, with less voltage loss, than in any other system.

An enclosed system, protected against breakdowns, sabotage and short circuits.

System is engineered for maximum efficient use of war-scarce materials. No rubber needed. Valuable aluminum saved for more critical war purposes.

Installation in a fraction of the time required for old-fashioned wiring.

Standard, interchangeable sections — 100% salvable. Instantly convertible from one production set-up to another.


BUStribution DUCT
"Plug-in" Power Direct to Each Machine
UNIVERSAL TROL-E-DUCT
Plugs in the Lighting As and Where Needed
INDUSTRIAL TROL-E-DUCT
Moves the Power with the Tool or "Load"

BULLDOG
ELECTRIC PRODUCTS CO.
DETROIT, MICHIGAN

BullDog Electric Products of Canada, Ltd., Toronto, Ontario

Field Engineering Offices in All Principal Cities

BULLDOG "PLUG-IN" SYSTEMS—THE ARTERIES THAT SUPPLY POWER AND LIGHT FOR WAR PRODUCTION

Make Better WIRE JOINTS Faster!

. . . AND CONSERVE CRITICAL MATERIALS

AVAILABLE NOW—"Wire-Nuts" do not use Lead, Tin and Rubber, as required for solder-and-tape joints; so their availability is not affected by shortages of these critical materials—and *your* work isn't delayed a minute.

Speed wiring jobs this fast, easy way. A pocket full of IDEAL "Wire-Nuts" and a wire stripper is all you need. The "Wire-Nut" threads onto the wire just like a nut on a bolt. Compare that with slow, messy solder-and-tape and you realize why contractors who use "Wire-Nuts" beat contract dates . . . And they get superior joints, neater, better electrically, stronger mechanically!

SIZES FOR EVERY JOB—For small conduit fittings as well as sizes large enough to join 3 No. 10 wires. FULLY APPROVED.

Listed by Underwriters' Laboratories, Inc.

SOLD THROUGH JOBBERS

Write for FREE Samples, Now

Other IDEAL War-Time Wiring Job Speeders

- Joist Borers
- Fish Tape Reel and Pullers
- Wire Strippers
- Cable Ripper
- Switch Box Supports
- B-X Armor Cutter

IDEAL

IDEAL COMMUTATOR DRESSER COMPANY
1041 Park Avenue Sycamore, Illinois
Sales Offices in All Principal Cities

Wire-Nuts

Solderless, Tapeless Wire Connectors

Speed up Fluorescent Fixture Installations and Repairs with "Wire-Nuts".

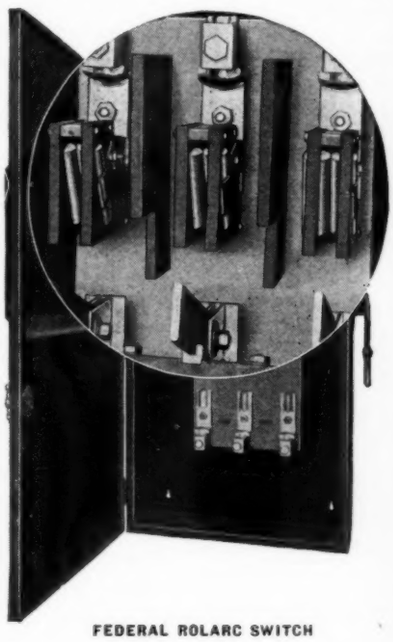
Roughing-in is greatly simplified with "Wire-Nuts". No danger of fires or burned woodwork.

EQUIPMENT News

[FROM PAGE 96]

Switch

This new type of long-life safety switch is known as the Rolarc. It is available from 100 to 400 incl. ampere capacity. Two cylindrical rollers fabricated from high-arc resistant material, are located above the final disengagement of the current rupturing members. These rollers form two parallel insulating barriers and are supported by a spring tension which, in the free position, holds the rollers flush against each other. When switch blade is opened it passes between lubricated rollers. Immediately upon disengagement of the blade from the "line" stationary jaw, the rollers snap together forming an insulated barrier that interrupts the arc. Those rollers rotate with each operation of the switch blade. Federal Electric Products Co., 50 Paris St., Newark, N. J.



FEDERAL ROLARC SWITCH

Instruments

A new sensitive electronic limit bridge for precision resistance testing has been developed. Meter dial is uniformly calibrated from zero center to ten per cent deviation on either side. Each division on dial reads one half• per cent. Simplified direct readings in plus and minus deviations from built-in predetermined resistance standard. Instrument also provides for external standards supplied to specified values. External and internal standards can bc used in combination. It is battery operated and self-contained in an oak case. Automatic cut-out switch disconnects batteries when instrument is not in use. Size is 14¾- by 10¼- by 8½-in. Radio City Products Co., Inc., 127 West 26th Street, New York.

for 600-Family Federal Housing Project at Bridgeport, Connecticut

At left is shown the flush type Colt Multi-Breaker installed in all apartments . . . below, the outdoor installation of Colt Meter Socket Troughs and a Colt Multi-Breaker in raintight enclosure.

Another Federal Housing Project — 150 buildings — 600 apartments — completely equipped with Colt Multi-Breakers and Colt Meter Socket Troughs.

All buildings are arranged for outdoor metering with 4-meter troughing units . . . in addition, on thirty-one buildings is mounted a Colt Multi-Breaker with an extra socket for clock switch to control the street lighting. In each of the 600 apartments, a Colt Multi-Breaker has been installed for distribution, circuit protection and control.

Write for Complete Information about COLT MULTI-BREAKERS . . . the Modern Way to Wire a House!

COLT'S PATENT FIRE ARMS MFG. CO. - Electrical Division - HARTFORD, CONN.

War- NO RESPECTER OF TOOLS

When a line must be strung—in a hurry—a soldier has no time to baby tools. Under war conditions, Klein pliers and equipment are proving the wisdom of the policy of extra quality—of added care in manufacture that has made the name of Klein synonymous with the finest in tools among linemen and electricians—everywhere. Today, as in the past, under the acid test of war, this equipment is proving to our sailors and our soldiers here and in foreign lands that, the extra quality that has characterized Klein equipment "since 1857" assures better work—performed on time.

Since 1857

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp., New York

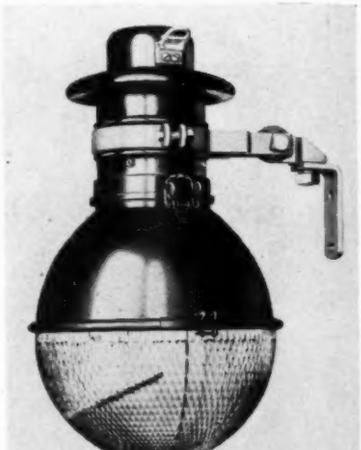
Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE CHICAGO

EQUIPMENT News

[FROM PAGE 98]

Protective Lighting Brackets

These adjustable brackets are designed for pole mounting of protective lighting luminaires where vertical and horizontal adjustments are required. The pendant type bracket is available for inner or outer wiring. It will accommodate both L-M Fresnel and L-M Prismalite luminaires. The clamp-around type bracket will accommodate Fresnel and Prismalite luminaire used in combination with L-M Clampolite wet process porcelain head. The porcelain is held in compression offering maximum mechanical strength and minimizes the danger of interruption of service should the porcelain head become broken. Line Material Company, 800 North Eighth Street, Milwaukee, Wis.



LINE MATERIAL BRACKET

■

Intercommunicating System

This intercommunicating system, known as Economical Expediter, consists of five station master and one sub-station. Installation can be made to include all masters to a total of five, a master and a maximum of five sub-stations, or a combination of masters and sub-stations to a total of five units. Operation on all systems is on 110 volts a.c. or d.c. Master station mechanisms are housed in walnut cabinets. Sub-stations are completely enclosed in metal cases. In a system having one master and a set of sub-stations known as the Master Selective type, stations can be placed at any distance up to 2000 feet from each other and volume can be adjusted by volume control. All systems are available for use with 10, 20, 30, 40, 50, etc. stations. Talk-A-Phone Mfg. Co., 1219 W. VanBuren St., Chicago, Ill.

ANNOUNCING THE NEW NON-METALLIC

DUR-O-LITE

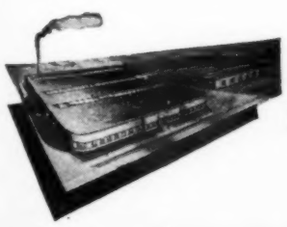
FLUORESCENT REFLECTOR

. . . A HIGHLY EFFICIENT NON-METALLIC FLUORESCENT REFLECTOR UNIT IN KEEPING WITH THE DESIGN SPECIFICATIONS SET BY THE BUREAU OF STANDARDS AND W.P.B.

Here's SPERO's answer to metal restrictions on fluorescent reflector units —the NEW DUR-O-LITE reflector with the high reflecting surface, easily cleaned and lasting finish. Designed to meet Bureau of Standards' and W.P.B. requirements, this unit continues to maintain the established high efficiency factor synonymous with the name SPERO.

In construction this unit is similar to SPERO's IU248 unit. It's particularly designed for war plant use . . . wiring, auxiliaries and starters are mounted in raceway above reflector . . . reflector can be easily dropped for cleaning or maintenance . . . knockouts make conduit or flexible cable mounting possible . . . designed for continuous end-to-end mounting . . . made for 40-watt or 100-watt tubes for 110-125 volt A.C., also for other voltages . . . can be had with perforations for three tubes at no extra cost.

We urge you to write, wire or phone us immediately regarding this METAL-SAVING FLUORESCENT UNIT . . . it's available to meet your vital lighting needs . . . it uses a minimum of essential materials . . . it gives highest efficiency for today's lighting requirements. ACT NOW TO PUT BETTER LIGHT WHERE BETTER SIGHT IS NEEDED!



...5 LINES *of Products from one dependable source*

FLUORESCENT FIXTURES—INCANDESCENT REFLECTORS—FLOODLITES —VAPOR PROOF UNITS—ELECTRICAL CONSTRUCTION MATERIALS

THE SPERO ELECTRIC CORPORATION
18222 LANKEN AVE. ★ CLEVELAND, OHIO

YOU GET ALL THREE with a BLACKHAWK Pipe Bender

Blackhawk Benders do MORE than bend pipe. They include a Porto-Power Hydraulic Unit that can be used separately from the bending attachments. Here is the triple utility:

1 PIPE BENDING

Smooth, remotely controlled hydraulic power bends rigid conduit and pipe up to 4" diameter. Saves need for elbows and couplings and otherwise necessary cutting and threading.

2 MAINTENANCE AND PRODUCTION

Big range of attachments adapt the hydraulic unit to push, pull, bend, press, spread and clamp work. Pull gears and pulleys, lift machinery, (as shown at left)—do scores of other jobs allied to pipe bending.

3 SPECIAL JACK

Compact 10 or 20-ton ram (same as used in pipe bending) works in all directions — and at any angle. Preferred to all other types of jacks.

MAIL COUPON TODAY

BLACKHAWK MFG. COMPANY
Dept. P2092, Milwaukee, Wis
Send Full Information on your Pipe Benders.

Name.....

Company.....

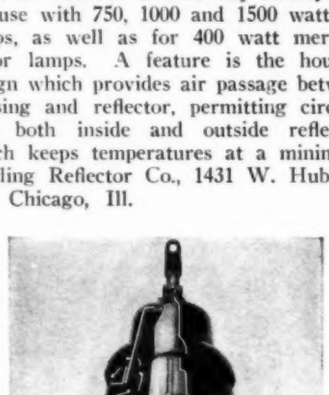
Address.....

EQUIPMENT News

[FROM PAGE 100]

Lighting Unit

A new unit for lighting high and medium high factory spaces, airplane hangars, etc. has been announced. It is known as Sterling No. 5526 and consists of a silvered glass reflector with Lite-Flo stipple in a metal housing with adjustable porcelain socket. Socket may be adjusted for use with 750, 1000 and 1500 watt PS lamps, as well as for 400 watt mercury vapor lamps. A feature is the housing design which provides air passage between housing and reflector, permitting circulation both inside and outside reflector, which keeps temperatures at a minimum. Sterling Reflector Co., 1431 W. Hubbard St., Chicago, Ill.



STERLING LIGHTING UNIT

■

Instrument

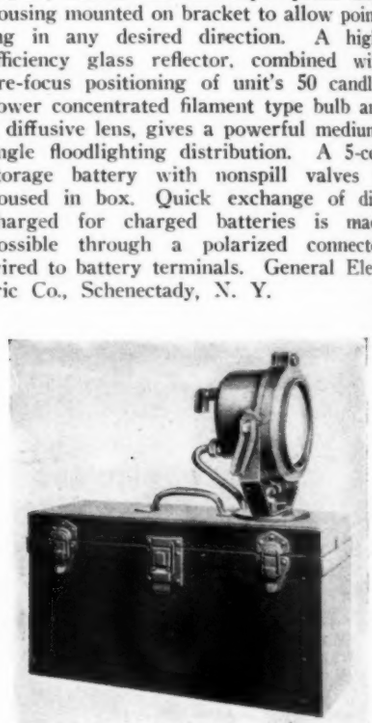
This multitester, No. 423, a general utility volt-ohm-milliammeter, is for industrial and commercial use. The 3-inch square meter has a movement of 395 microamperes or a sensitivity of 2,500 ohms per volt, while the instrument has a uniform a.c. d.c. voltmeter sensitivity of 1,000 ohms per volt. Other features include high ohmmeter range of 10 megohms, each shunt and multiplier individually calibrated to a close tolerance, while all multipliers are individually matched in pairs so that overall accuracy is within one per cent. Radio City Products Co., 127 W. 26th St., New York.

RCP INSTRUMENT

■

Portable Floodlight

A portable battery-operated floodlight, especially for combustible areas which cannot have installed lighting, has been developed. This unit is for use in such places as powder igloo interiors, powder magazines, freight car and warehouse interiors containing combustibles and during blackouts and other emergencies. It consists of a steel box, 19- by 9-$\frac{7}{8}$-in. by 20$\frac{3}{4}$-in., with a dust and vapor proof lamp housing mounted on bracket to allow pointing in any desired direction. A high-efficiency glass reflector, combined with pre-focus positioning of unit's 50 candlepower concentrated filament type bulb and a diffusive lens, gives a powerful medium-angle floodlighting distribution. A 5-cell storage battery with nonspill valves is housed in box. Quick exchange of discharged for charged batteries is made possible through a polarized connector wired to battery terminals. General Electric Co., Schenectady, N. Y.



G-E PORTABLE FLOODLIGHT

■

Tester

This instrument is for testing voltage breakdown of materials or components. Housed in a metal cabinet with sloping panel, it consists of a step-up transformer controlled by a variac; current-limiting resistors safeguarding equipment in event of a dead short; a relay indicating by panel light when there is a breakdown; meter providing direct-reading voltages; and rectifier and filter circuit providing high-voltage d.c. High voltage is applied by a fixture or test prod connecting proper receptacle on instrument panel, as well as by second connection to ground binding post on panel. It operates on 110-volt 60 cycle a.c. Industrial Instruments, Inc., 156 Culver Ave., Jersey City, N. J.

Your Ceiling Prices

[FROM PAGE 20]

costs in accordance with the labor hour formula given here, computing the number of labor hours your journeymen work and adding the pro-rata share of overhead. If you must freeze your service prices at loss figures, you have three ways out. Cut your overhead expense under the March total, the dollar expense, we mean, not the percentage used in computing estimates, cut your labor cost by better supervision or improved equipment, if you can get it, or increase service repair volume to reduce the ratio of overhead to sales. According to Section 2 in the General Maximum Price Regulation, you cannot exceed the maximum prices charged for the same or similar commodities or services during March, so you cannot revise prices upward if analysis discloses that they are inadequate to take care of overall costs. You must cut costs or increase sales with effective advertising and selling promotion. But, first, you must analyze your operating figures on service or repairs to know where they stand on this critical problem. Because repair sales should outrank sales of electrical goods for many contractors during this war, those who knowingly or unknowingly hog-tie themselves to a loss on service because of slaphappy costing or recording, will find the deficit increasing with the months. So, take the necessary steps to correct a dangerous situation now.

Overhead Methods

An important consideration overlooked by many contractors is that the overhead percentage used on current jobs is usually the percentage on sales for the previous year or in other ways based upon the previous year's ratios. In other words, such contractors were costing March jobs with an overhead percentage ratio for 1941. If expenses had remained stationary from January 1941 to March 1942, no harm is done but everyone knows that expenses during this period were on the upgrade and that some contractors expanded, which would tend to make the March percentage too low. The contractor who has trouble earning profit under price ceilings will find it due to the use of an overhead percentage that is too low because it is too old. If he used such a percentage on March repair jobs, he should apply correctives as outlined in this article, using the labor hour cost as the basis of computation.

Light

WHERE YOU NEED IT... WHERE YOU WANT IT...

For full illumination of Parts Bins, Tool Crib Bins and Shelves, Stockroom Shelves, Carton Stacks, File Rooms, Library Stacks — wherever you need "quick, accurate seeing" from top to bottom, install PERMAFLECTORS, the silvered-glass reflectors especially designed for this purpose. Easily, quickly, inexpensively installed. Get prompt delivery . . . No priority on GLASS!

HIGH-EFFICIENCY PERMAFLECTORS of SILVERED GLASS

Conserve Critical War Materials Assure Prompt Delivery!

Decrease Spoilage — Reduce Accidents — Speed Production

Pick Up

THE WEAK SPOTS IN YOUR PLANT!

Need MORE light, BETTER light here and there in your production line? ✪ Put in Permaflector "Auxiliaries" — the high-efficiency, silvered-glass reflectors that put the light where you need it, as you want it! ✪ A size and shape for any desired distribution. ✪ Easily, quickly, inexpensively installed without affecting work flow. ✪ Use Minimum Critical War Materials! ✪ Specify Permaflectors! ✪ A Pittsburgh lighting engineer will be glad to go over your plant without obligation!

PITTSBURGH REFLECTOR CO.

"Pittsburgh" Permaflector

402 OLIVER BLDG. - PITTSBURGH, PA.

Tear Off

Clip to letterhead. Sign. Mail for complete information, prices.

In the News

EMERGENCY CODE COMMITTEE HOLDS SECOND CONFERENCE

Machine tool wiring rules, code amendments to permit the use of rubber substitutes, motor overcurrent protection and a number of other changes in the National Electrical Code were reviewed and approved by the second conference of the Emergency Committee of the Electrical Committee, NFPA. The meeting was held in New York on Tuesday, August 4, with Chairman Alvah Small presiding. The following members of the committee were present: L. F. Adams, George Andrae, E. A. Brand, M. M. Brandon, Paul Ferneding, R. L. Lloyd, J. D. Lynett, W. J. Mahan, A. H. Schirmer, and V. H. Tousley. E. S. McConnell was present as alternate to Member Brand. R. B. Shepard sat in the meeting as a guest. Upon approval of the committee, A. B. Smith was authorized to act as alternate to Member Adams.

As a matter of policy it was voted that any member, alternate, or special member of the Electrical Committee be authorized to attend the meetings at any time as an observer; and that others should be authorized to attend the meetings only by invitation of the Committee. Frank Thornton, Jr., a member of the Electrical Committee, attended this second meeting of the Emergency Committee as an observer.

A question was presented at the first meeting of the Emergency Committee as to whether Interim Amendment No. 47, on the recognition of varnished-cambric insulated armored cable, was intended to recognize for conductor insulation of 0-600 volts the thickness of metal armor strip now approved under section 7111 of the 1940 Code for armored cable for voltages over 600.

After an extended discussion of the points involved, during which Mr. McKinley of the General Electric Company was invited to address the meeting, the following interim amendment was adopted:

INTERIM AMENDMENT NO. 68. Section 93341, 1940 National Electrical Code. Approved August 4, 1942.

Amend section 93341 of the 1940 National Electrical Code, on varnished-cambric armored cable, by the addition of the following note:

For the duration of the war, armored cable of No. 4 and larger, for 600 volts or less, installed as exposed work in industrial locations, may have a metal armor strip of the thickness now approved under section 7111 of the 1940 National Electrical Code for armored cable for more than 600 volts.

Consideration was given to the conductor insulation of treated paper and an outer braid as previously submitted to the Emergency Committee by the Anaconda Wire & Cable Company, and briefly described in the minutes of the June 30 meeting of the Emergency Committee. A special subcommittee including Messrs. Ferneding, Lynett, and Brandon, appointed at that meeting to confer with S. J. Rosch on additional tests of the insulation submitted, reported to the meeting as follows:

"Several meetings of the Special Committee were held and as a result of the discussion of the characteristics of the material as brought out by the original tests and the supplementary tests, the following recommendations were agreed upon:

1. That TF wire be permitted for the Emergency in nonmetallic sheathed cable, knob-and-tube wiring, and open wiring.
2. That the maximum operating voltage be 600 volts.
3. That the thickness of insulation be such that the over-all diameters will be comparable with those for Type R wires of the same gauge.
4. That the material be marked with the manufacturer's name and the type designation "EP" throughout the length of the wire.
5. That wire of this type be examined and tested at the factory and, if approved, be labeled before shipment.
6. That in junction and pull boxes where more than four conductors larger than No. 10 are used, the conductors be individually wrapped in noncombustible tape.

The material is judged unsuitable for use in damp locations or for use in hazardous locations.

No agreement was reached with re-

"But I thought I could charge anything I wanted to for floor plugs? The Government only specified ceiling prices!"

KEEP 'EM LIGHTED SAFELY!

Specify APPLETON Explosion-Proof or Vapor-Tight Lighting Fixtures and Fittings

on Every Exacting Job!

Type "EVA" Explosion-Proof Lighting Fixture (Pendent Type)

Appleton Explosion-Proof Lighting Fixtures
"THE COMPLETE LINE"

Uninterrupted war production demands *safety* in hazardous locations—the *extra margin* of safety offered by APPLETON Explosion-Proof Lighting Fixtures and other equipment.

Hundreds of APPLETON types— all expertly designed, all skillfully built in Appleton's own foundries and fabricating plants—include *exactly the right* fixture or fitting for every installation. All are Underwriters' Laboratories approved and conform to every code requirement.

To save time—specify APPLETON on every order!

Type "VC" Vapor-Tight Lighting Fixture From 100—Screw-Type Gua

Appleton Vapor-Tight Lighting Fixtures
"THE COMPLETE LINE"

For locations where moisture due to steam or other vapors may cause serious trouble. Don't take chances — specify APPLETON Fixtures—highest quality, modern design, conforming strictly to all code requirements.

"The Complete Line" includes 16 different Vapor-Tight "Unilet" bodies, in a range of sizes and options as to lamp-guards, colors, switches, lamp-grips and reflectors that make possible thousands of different lighting combinations.

Whatever any job requires—save time by specifying APPLETON!

Sold Through Wholesalers

APPLETON ELECTRIC COMPANY

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Branch Offices: NEW YORK, 76 Ninth Avenue • DETROIT, 7310 Woodward Avenue • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna Street • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 North Santa Fe Avenue • ATLANTA, 203 Luckie Street, N.W. • BIRMINGHAM, 6 N. Twenty-first Street • MINNEAPOLIS, 305 Fifth Street, S. • PITTSBURGH, 418 Bessemer Bldg.

Resident Representatives: Baltimore, Boston, Cincinnati, Dallas, Denver, Kansas City, Milwaukee, New Haven, New Orleans, Philadelphia, Seattle.

APPLETON

Conduit Fittings • Outlet and Switch Boxes • Explosion-Proof Fittings • Reelites

In the News

[FROM PAGE 104]

spect to the use of this wire in conduit, electrical metallic tubing, or other metal raceway so no recommendation is being made."

A new type of conductor insulation, together with an Underwriters' Laboratories, Inc. fact-finding report on it, was submitted by the National Electric Products Corporation. This insulation is intended to replace rubber insulation for all standard sizes of conductors for the duration of the war. The insulation consists of a layer of cellulose-acetate butyrate (termed Kodapak by the manufacturer) placed directly over the copper conductor, surrounded by a spirally wound wrap of paper and an outer braid of fibrous material.

The cellulose-acetate butyrate is applied as two 0.0016-in. strips lapped around the conductor and with each strip lapped over itself, thus forming two concentric tubes. These strips are sealed through the operations that follow. The paper, which is of a specially treated nature, is applied over the cellulose-acetate butyrate strips in folds which are ironed down to give a round exterior. The outer braid is similar to that on a standard rubber-covered conductor and the over-all diameter is the same as corresponding sizes of rubber-covered conductors.

During the consideration of these two conductor insulations by the Emergency Committee, S. J. Rosch, of the Anaconda Wire & Cable Company, and R. W. E. Moore, of the National Electric Products Corporation, were invited to address the committee.

After a discussion that extended over several hours, the following interim amendment to the Code was adopted:

INTERIM AMENDMENT No. 69. Section 3005, 1940 National Electrical Code. Approved August 4, 1942.

Add a note to section 3005 of the 1940 National Electrical Code, on Types of Conductor Insulation, to read:

To assist in conserving rubber, and for the duration of the emergency, conductors with emergency insulation (Type EI†) may be used as the ungrounded conductor for nonmetallic sheathed cable run exposed and for open wiring on insulators under the following conditions: (1) in dry locations only; (2) for voltages not exceeding 600 volts; (3) if there are more than four conductors larger than No. 10 in an outlet or junction box, or in a cabinet or cutout box, the conductors must be individually wrapped with noncombustible, insulating tape. Type EI conductors shall not be used in damp or wet locations; nor in any hazardous locations except as provided for open work in section 5075.

† Note: Underwriters' Laboratories, Inc. will test and label wire with this new type of insulation. The details of the standards for listing will be determined by the Laboratories through an industry conference. The thickness of insulation shall be such that the over-all diameter will be that of corresponding gauge sizes in standard rubber-covered conductors.

Interim Amendment No. 44, as amended at the Emergency Committee meeting of June 30 (Page 5 of minutes), on the recognition of slow-burning weatherproof, weatherproof conductors, and other type specially approved for the purpose, as the grounded conductor on wiring systems of 600 volts or less, was further amended by inserting after the words "Type WP" in the fifth line of the report of June 30 the words and letters "emergency insulated conductors (Type EI)"; and by deleting the words "provided the circuit does not operate at more than 600 volts to ground" which appears at the end of the paragraph.

Interim Amendment No. 44 on Types of Conductor Insulation, as further revised, will now read:

INTERIM AMENDMENT NO. 44. Section 3005, 1940 National Electrical Code. Approved April 9, 1942, Revised June 30 and August 4, 1942.

To assit in conserving rubber and for the duration of the emergency, on alternating-current systems, slow-burning weatherproof conductors (Type SBW), weatherproof conductors (Type WP), emergency insulated conductors (Type EI), or other type specially approved for the conditions, may be used as the grounded conductor in any of the wiring methods of Articles 320 to 364 inclusive of this chapter.

SB, SBW, and WP Conductors for Concealed Work

The Special Committee appointed at the June 30 meeting of the Emergency Committee consisting of Messrs. Brand and Mahan to study the question of recognition of slow-burning (Type SB), slow-burning weatherproof (Type SBW), and weatherproof (Type WP) conductors for concealed (knob-and-tube) work (Page 4 of minutes), reported that the sub-committee had no recommendation to make. A motion to recognize these insulations for concealed knob-and-tube work received no support. The report was received and the special committee discharged. No further action on this subject was taken by the Emergency Committee.

MOTOR PRICE HUDDLE finds (L. to R.) L. R. Bradford, Bradford Armature Works, East St. Louis, Ill.; T. M. Russell, Russell Electric Motor Repair Shop, Mobile, Ala.; and J. M. Chandlee, Century Electric Co., St. Louis, Mo., talking over rebuilt motor prices.

WHEN INSPECTORS MEET interesting stories are told. Amusing experiences are being swapped in Chattanooga by (L to R) W. L. Williams, Chief Electrician, City of Cattanooga; E. D. Armstrong, Tennessee State Electrical Inspector, Knoxville; and H. L. Thomas, Chief Electrical Inspector, City of Memphis.

Machine Tools

On motion of Member Ferneding, who is Chairman of the Technical Subcommittee, Article 670 on Machine Tools, as printed on Page 104 of the Report of the Article Committees issued July 1, 1942, was approved as an interim amendment for the duration of the war. Chairman Small stated there was no conflict between Article 67 and the ASA Standard on Machine Tools.

INTERIM AMENDMENT NO. 70. Article 670, 1940 National Electrical Code. Approved August 4, 1942.

Amend the 1940 National Electrical Code by inserting the following as the text of a new article, Article 670, Machine Tools.

ARTICLE 670—MACHINE TOOLS

General

6701. Scope. The provisions of this article apply to the electrical equipment for motor-driven, complete metal-working machines, not portable by hand, having one or more tool and work holding devices used for progressively removing metal in the form of chips.

6702. Application of Other Articles. The following provisions cover the requirements for electrical wiring and equipment on machine tools within the scope of this article. They are in addition to or amendatory of the applicable provisions of other articles of this code, which apply except as modified in this article.

Wiring Method

6711. Conduit. Conductors shall be in rigid metal conduit, except as provided in sections 6712 to 6714, inclusive.

6712. Flexible Metal Conduit. Flexible metal conduit may be used only where necessary to employ flexible connections for small or infrequent movements, as at motor terminls, and pro-

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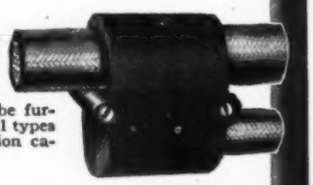

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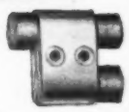

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In the News

[FROM PAGE 106]

vided that the flexible metal conduit is not subject to oil or moisture.

6713. Continuously Moving Parts. Wiring connections to continuously moving parts of a machine tool shall be of approved type, extra-flexible, non-metallic-covered, multi-conductor cable. Conductors shall conform to section 6722.

6714. Compartments and Raceways. Compartments and raceways within the framework of a machine tool may be used to enclose conductors, provided they are isolated from coolant and oil reservoirs and are entirely enclosed. Conductors in machine compartments and raceways shall be secured and so arranged that they will not be subject to mechanical injury or abrasion.

6715. Number of Bends in Conduit. If a run of rigid metal conduit does not exceed 25 feet in length, and the conductor fill does not exceed 30 per cent of the cross-sectional area of the conduit, the requirements of section 3471 shall not apply.

Conductors

6721. Sizes Permitted. Branch-circuit and control conductors shall not be smaller than No. 14, except that control conductors in flexible, non-metallic, multi-conductor cable to continuously moving parts may be as small as No. 16 if all such conductors are insulated for the maximum voltage of any conductor in the cable.

6722. Type. Conductors shall be of a type suitable for conditions of use. Type SN wire shall be used where subject to oil or coolant. Flexible, non-metallic, multi-conductor cable shall have an oil- and moisture-resistant insulation with a flame-retardant outer covering.

6723. Identification of Conductors. Conductors shall be identified either by color code or by other distinctive means. White or natural gray coloring shall be used only for a grounded conductor, and green only for a conductor used to ground the frame of equipment.

Control Equipment

6731. Mounting. Controllers shall be mounted in such a manner as to guard against mechanical injury, oil, coolant, dust, and dirt.

6732. In Machine Compartments. Compartments in the column or base of a machine may serve as enclosures for control equipment if the following provisions are compiled with:

a. Thickness of Metal. The wall thickness shall be not less than No. 14 USS sheet metal gauge if of sheet steel, not less than $\frac{1}{8}$ inch if of cast metal, or not less than $\frac{3}{32}$ inch if of malleable iron.

b. Covers. Compartments shall have tight-fitting hinged covers, not thinner than specified in paragraph a. Covers shall have adequate means for fastening securely in a closed position.

c. Control Enclosures. Compartments used for control enclosures shall be readily accessible and shall not contain moving parts not directly connected to electrical control equipment, and shall be so located as to guard the control devices against oil, coolant, chips, and dirt.

d. Ventilation. A compartment enclosing group control equipment with branch circuit fusing as specified in paragraph b of section 6742, shall have a clear opening of at least 2 square inches, vented to another compartment within the column or base and having at least one-half the volume of the control compartment.

e. No Floor Opening. Compartments enclosing control equipment shall not be open to the floor or foundation upon which the machine rests.

Motor Branch-Circuit Overcurrent Protection

6741. One Branch Circuit. The conductors supplying all motors on a single machine tool may be considered a single branch circuit, which must comply with the provisions for motor branch circuits in Article 430 except as modified in section 6742.

6742. Several Motors on One Branch Circuit. Controllers and running overcurrent protective devices for two or more motors connected to the branch circuit of a single machine tool need not comply with the provisions of section 4343, if all of the following provisions are complied with:

a. Motor-Running Protection. Each motor shall be protected by a motor-running overcurrent protective device.

b. Rating of Overcurrent Devices. The branch circuit shall have overcurrent protection of a rating equal to that specified in section 4342 for the largest motor connected to the circuit, plus an amount equal to the sum of the full-load current ratings of the other motors on the machine tool connected to the same circuit, but in no case larger than 200 amperes at 250 volts or less, or 100 amperes at 600 volts or less.

c. Enclosure. The control equipment and running protective devices are enclosed in compartments complying in all respects with the provisions of section 6732.

d Conductors. The conductors of the

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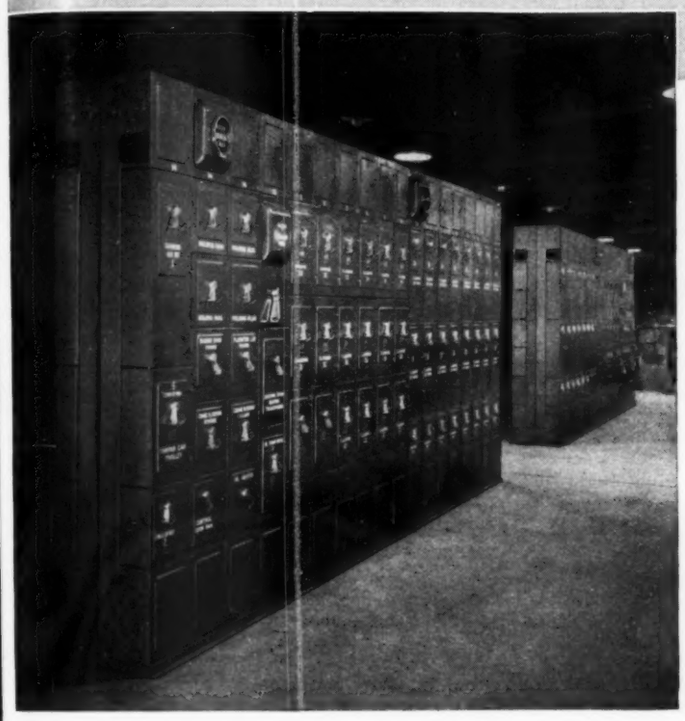

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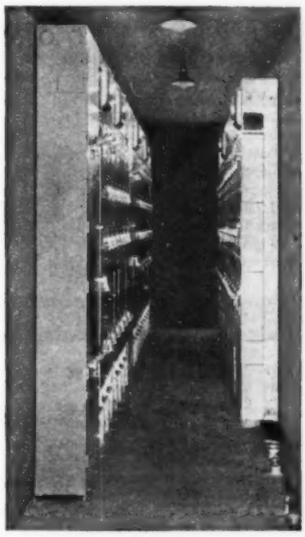

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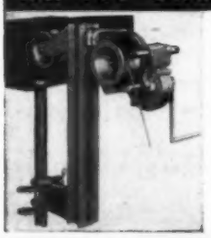

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In the News

[FROM PAGE 108]

branch circuit shall comply with the provisions of paragraph b of section 4343.

Protection and Grounding

6751. Protection Against Damage. If the failure of one motor to operate while others continue to run could cause damage, they shall be so connected that the tripping of any overload or undercurrent device will result in stopping all of these motors.

6752. Grounding. All machine tools within the scope of this article, including connected portable equipment, shall be effectively grounded as specified in Article 250.

6753. Moving Parts. A machine part that moves on grounded metal guides or supporting ways shall be considered as adequately grounded if the movable part may not readily be removed by hand.

Separation of Conductors, Open Work

In order to reduce reactance effects on open wiring on three-phase circuits, it is desirable to locate conductors in the form of an equilateral triangle where all phase wires have equal distance separations. There are fittings now on the market that provide for this arrangement, and although they meet the Code separation requirements of section 3205 for voltages not exceeding 300, they do not conform to the separate requirements for 300–600 volts.

After a study of the situation, the Emergency Committee approved the following interim amendment:

INTERIM AMENDMENT NO. 71. Section 3205, 1940 National Electrical Code. Approved August 4, 1942.

Revise section 3205, Spacing, to read: Open conductors in dry places shall be separated 2½ inches from each other and ½ inch from the surface wired over. In damp or wet locations a separation of at least 1 inch from the surface wired over shall be maintained.

The Emergency Committee also gave consideration to a further modification of section 3205 that would permit a 1¼-inch separation between conductors, but a motion to this effect was laid on the table.

Chairman Small informed the Emergency Committee that Interim Amendment No. 62 on the adoption of the proposed revision of Article 500 of the Code as an interim amendment had failed to receive the necessary two-thirds affirmative vote of the Electrical Committee and was therefore not approved as an interim amendment.

Interim Amendment No. 40 Revised

Mr. Shepard called attention to the fact that the Code did not specify the carrying capacity of No. 20-gauge cord, and it was voted that Interim Amendment No. 40 on Note 1 of Tables 1 and 2 be further revised to add a new sentence to Note 1, reading:

> The allowable current-carrying capacity of No. 20 is 3 amperes.

Federal Specifications

Mr. Shepard brought up several items now before the Federal Specifications Committee covering the subjects of Type PO and similar cords; ⅝-inch insulation on No. 8 conductors; and the carrying capacity of weatherproof conductors. It was agreed that these matters would have consideration at the next meeting of the Emergency Committee.

Fixture Studs in Insulated Boxes

Mr. Brandon brought up the subject of fixture studs in outlet boxes of insulating material. He stated that the Laboratories had turned down such a box as it was in violation of the National Electrical Code. He was requested to consult with the interested groups of the industry and to submit a brief on the points under question at the next meeting of the Emergency Committee.

Interim Amendment No. 44

F. O. Evertz of the Electrical Committee called attention to the wording of revised Interim Amendment No. 44, as reported in the minutes of the June 30 meeting of the Emergency Committee. He stated that the expression "600 volts to ground" was apparently in error. The point has been taken care of by the revision of Interim Amendment No. 44.

Next Meeting

The next meeting of the Emergency Committee will be held on September 10, 1942.

LOBBY DISCUSSION of proposed Tennessee State License Law for electricians is held at the Read House, Chattanooga, by (L to R) B. T. Dawkins, Memphis; C. E. Terrell and L. A. Ragon, Chattanooga contractors.

MOTOR CONSERVATION URGED

The WPB has asked electric motor manufacturers to adopt a conservation program covering the selection and use of motors to save critical materials following a conference of industry representatives with the electric motor and control section of WPB.

The program calls for operating motors at maximum capacity in industrial applications disregarding overload factors that would normally be considered. Purchasers

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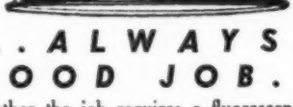

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In the News

[FROM PAGE 110]

of new motors are asked to choose the simpler types of equipment such as single-speed in preference to multi-speed, open type rather than totally enclosed, high speed instead of low speed, etc.

L. A. Umansky, assistant manager of General Electric's industrial engineering department, urges careful selection of motors on the basis of actual expected duty. "Conservation in motor selection, however commendable in normal times, must be discarded for the duration", he says, in urging adherence to the following five principles aimed at conserving critical materials.

1. Select motors closer to their actual duty—avoid piling up "safety margins."

2. If in doubt, do not arbitrarily select the next larger rating; perhaps the next smaller rating will do the job satisfactorily.

3. Utilize, wherever possible, the available service factor. For instance, the motor will not be injured if the service factor of 1.15 is used in some cases on the 40 C motors, although continuous operation at the resulting 50 C rise may mean that the insulation will last only 10 years rather than 20. Even more loading, up to 125 per cent can be utilized when ambient temperatures less than 40 C are expected.

(Of course, always check other factors such as starting or maximum torque, etc. Sometimes these, rather than the continuous rating, determine the motor size.)

4. Don't use integral horsepower motors for voltages less than 440 volts, unless unavoidable.

5. Bring high-voltage power to the load center.

CODE EMERGENCY AMENDMENTS

Approval for the duration of the war for the following interim amendments to the National Electrical Code has been announced by the Electrical Committee, NFPA.

TENTATIVE INTERIM AMENDMENT NO. 57:

Revise text of Section 3814 of the 1940 edition (Page 132) so as to read as follows:

3814. Rating of Snap Switches:

"a. For non-inductive loads other than tungsten-filament lamps, switches shall have an ampere rating not less than the ampere rating of the load.

"b. For tungsten-filament lamp loads, and for combined tungsten-filament and non-inductive loads, switches shall be 'T' rated, except where the three following qualifications are satisfied.

"1. If switches are used in branch circuit wiring systems in private homes; in rooms in multiple-occupancy dwellings used only as living quarters by tenants; in private hospital or hotel rooms; or in similar locations but not in public rooms or places of assembly; and

"2. Only when such a switch controls permanently connected fixtures or lighting outlets in one room only or in one continuous hallway where the lighting fixtures may be located at different levels or on porches or in attics or basements not used for assembly purposes; and

"3. When the switch is rated at not less than 10 amperes, 125 volts; 5 amperes, 250 volts; or for the 4-way types, 5 amperes, 125 volts; 2 amperes, 250 volts.

"c. Switches controlling inductive loads shall have an ampere rating twice the ampere rating of the load unless they are of a type approved as part of an assembly or for the purpose intended.

"For switches on signs and gas-tube lighting, see Section 6005.

"For switches controlling motors, see Section 4383."

Special Note: This new text is to be Section 3815 according to the plans of the Article Committee for the next edition of the Code. Until that edition is published, designation as Section 3814, as in the present edition of the Code, appears appropriate.

TENTATIVE INTERIM AMENDMENT NO. 59:

Revise Section 3882 of Article 384 (Page 135) so that it will read:

"3882. Overcurrent Protection. A panelboard supplied by conductors having overcurrent protection greater than 200 amperes shall be protected on the supply side by overcurrent devices having a rating not greater than that of the panelboard. Snap switches rated at 30 amperes or less and employed in panelboards shall have overcurrent protection not in excess of 200 amperes."

TENTATIVE INTERIM AMENDMENT NO. 60: Paragraph C, Section 6206, Article 620

"Revise paragraph (c) of Section 6206 to read as follows:

"'(c) BETWEEN MOTORS, GENERATORS AND CONTROL PANELS.

"'The conductors of circuits between motors, generators and control panels may be grouped without any additional insulation of the separate conductors if the complete group is either taped or corded, and such covering properly painted with an insulating paint; provided, that such conductors are not over 6 ft. long supported at

***DEFENSE HOUSING** material lists are given a thorough going-over by (L to R) M. H. DeFouw, Holland, Mich.; and F. J. Groleau, Muskegon, vice-president, Wolverine State Electrical Contractors Association.*

intervals not more than 3 ft. and are not so located as to be subject to mechanical damage or to a temperature in excess of 50 C (122 F). When motor generators are used with elevator motors and both are located adjacent to or underneath the control equipment and are provided with extra length terminal leads, such leads may be extended to connect directly to the elevator controller or motor generator starter terminal studs without regard to the carrying capacity requirements of Articles 430 and 445; provided, that no such lead is longer than 6 ft.'"

2. The present fine-print Note, following paragraph (c), is to be continued without change in text.

3. Chairman Dendel of the Article Committee authorized the substitution of the word "more" for the word "less" in line seven of the new text. This is an editorial change for clarity and has no effect on substance.

CROSS REFERENCES:

5. It has been pointed out that an additional cross reference should be made in the text for new Section 2560, adopted as Tentative Interim Amendment No. 54. This cross reference is to Section 3372, approved as Wartime Emergency Interim Amendment No. 43.

6. Regarding Tentative Interim Amendment No. 47, approved May 7, it is said that the statement in paragraph (2) of said Bulletin is being interpreted as explaining that the effect of the Tentative Interim Amendment No. 47 is to require the substitution of varnished cloth-insulated wires for rubber-covered wires in the construction of armored cable. To avoid possible further misunderstanding, it is pointed out that the intent of the interpretation was to permit either rubber or varnished cloth insulation on the conductors used in the construction of armored cable.

INTERIM AMENDMENT NO. 61. Section 6112. Paragraphs (a), (b), and (c).

Substitute the following new text for Section 6112 for that given on Page 231 of the Code. (A Wartime Emergency—For the Duration Only, item).

"6112, Conductor Sizes:

"(a) Current-carrying Capacity. The al-

INGENUITY PLUS *might well characterize Eugene Anderson, vice president, Anderson's, Inc., Nashville, Tenn., motor service shop. Gene can sit down with a paper, pencil, a few scraps of metal, some spare parts and emerge with a new device that boosts his shop efficiency.*

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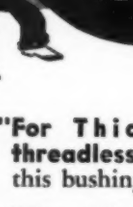
A **"For Thick-Wall conduit, threadless connection,** I use this bushing.

B **"For Thin-Wall conduit** I put in a bushing like it, but with a smaller grip diameter.

C **"For a Threaded connection** — a solid tapped bushing. ***All three are interchangeable.*** With a Kondu fitting, you can make ANY kind of connection at ANY outlet!"



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In the News

[FROM PAGE 113]

lowable current capacities of conductors shall be as follows:

"Current-carrying Capacities of Conductors Having Type R Insulation, Which Supply Crane and Hoist Motors.

Size AWG	AMPERES: For Motors Having 30 and 60 Minute Short-time Ratings	For Motors Having 5 and 15 Minute Short-time Ratings
16	10	11
14	20	22
12	25	28
10	35	39
8	45	50
6	57	63
5	65	72
4	77	85
3	90	99
2	107	118
1	130	143
0	160	176
00	195	215
000	245	270
0000	300	330

"The allowable current-carrying capacities of conductors having other than Type R insulation, supplying motors of 5, 15, 30, or 60-minute ratings, shall be as given in Tables I and II, Chapter 10, increased by 10 per cent.

"(b) Minimum No. 12. Rubber-covered conductors shall not be smaller than No. 12 except on small portable hoists where No. 14 or No. 16 may be used provided the conductors are protected against mechanical injury and on pilot circuits of controllers where No. 14 may be used.

"(c) Collector Conductors. The size of collector wires shall not be less than the following:

"Distance Between Rigid Supports	Size of Wire
0-30 feet	No. 6
31-60 feet	No. 4
over 60 feet	No. 2

"(Note: Proposed paragraph (c) above is present paragraph (b)."

INTERIM AMENDMENT NO. 63. Section 3004. Approved June 30, 1942.

Add a second note to Section 3004 of the 1940 National Electrical Code to read:

"For the duration of the emergency and to assist in the conservation of copper, conductors having varnish-cambric insulation (Type V), or asbestos varnished-cambric insulations (Type AVA, AVB, and AVL), that are not operated continuously with maximum currents and are in raceways or cable assemblies, may have the allowable current-carrying ratings given in the following table; and the limits of allowable current because of more than three conductors in a raceway or cable (Note 5, Page 303, 1940 Code), and because of room temperature being over 30 C (Table 1, Page

HAPPY TRIO *forming a part of the New York State delegation to the recent NISA meeting at Cincinnati, Ohio includes (L to R) A. T. Volland, Erie Electric Co., Buffalo; H. A. Schreck, Mt. Vernon; and H. R. Herold, Tri-State Electric Motors, Inc., Troy.*

301, 1940 Code), need not be applied. For single conductors in air, Table 2 of the 1940 Code shall apply.

"Allowable Current-Carrying Capacities of Conductors of Type V, AVA, AVG, and AVL, in Amperes.

Size AWG MCM	Asbestos Var-Cam Type AVB / Var-Cam Type V	Asbestos Var-Cam Type AVA Type AVL
14	23	28
12	29	36
10	38	47
8	50	60
6	68	80
5	78	94
4	88	107
3	104	121
2	118	137
1	138	161
0	157	190
00	184	217
000	210	243
0000	270	275
250	300	315
300	330	347
350	360	392
400	390	418
500	480	480
600	540	540
700	600	600
750	630	630
800	660	660
900	720	720
1000	780	780
1250	900	900
1500	1020	1020
1750	1140	1140
2000	1260	1260

INTERIM AMENDMENT NO. 64. Section 3203. Approved June 30, 1942.

Delete Interim Amendment No. 45 which added a fine-print note to Section 3203, to read: "Slow-burning weather-proof conductors (Type SBW) may be used for open wiring on insulators in dry locations where the room temperature exceeds 60 C (140 F) but does not exceed 90 C (194 F)"; also

Section 3005, Table (Page 87). For "Slow-burning" and for "Slow-burning Weatherproof," in the fourth column under "Other Limitations," delete the words "where room temperature exceeds 85 C (185 F)," so that the two notes will read: "For use only in dry locations"; also

Section 3005, Paragraph a. Delete the first sentence; also

Section 93001, Paragraph d, Table (Page 287). For "slow-burning" and for "Slow-burning Weatherproof," in the last column under "Use," delete the words "where room temperature exceeds 85 C (185 F)," so that the notes will read: "For use only in dry locations."

Editor's Note: Section 3203 will now read as in the 1940 Code.

INTERIM AMENDMENT NO. 65. Section 2357. Approved June 30, 1942.

Amend the present first sentence of Section 2357 to read: "A service switch shall have a rating not less than *the load to be carried as determined by Section 2108.*"

INTERIM AMENDMENT NO. 66. An addition to Interim Amendment No. 41. Approved June 30, 1942.

Add a note to Interim Amendment No. 41 to read:

"'Continuous operation' as referred to in the preceding paragraph is operation where the load exceeds three consecutive hours or six non-consecutive hours at the maximum rating listed, during any 24-hour period."

INTERIM AMENDMENT NO. 67. Section 2452. Adopted June 30, 1942.

Delete Section 2452 from the 1940 National Electrical Code for the duration of the war.

COMING MEETINGS

National Electrical Contractors Association—Annual Convention, Bigwin Inn, Lake of Bays, Ontario, Aug. 31–Sept. 5.

International Association of Electrical Inspectors—Northwestern Section, Portland, Oregon Sept. 14–16. Southwestern Section, Fresno, Cal., Sept. 21–23. Western Section, Book-Cadillac Hotel, Detroit, Mich., Oct. 5–7. Eastern Section, Hotel Taft, New Haven, Conn., Oct 12–14. Southern Section, Richmond, Va., Oct. 19–21.

International Association of Electrical Leagues—Seventh Annual Conference, Hotel Cleveland, Cleveland, Ohio, Sept. 17–19.

Illuminating Engineering Society—Wartime Lighting Conference, St. Louis, Mo., Sept. 21–22.

National Electrical Manufacturers Association—Annual Meeting, Waldorf-Astoria Hotel, New York, N. Y., Oct. 26–30.

ALLOWABLE CONTRACT COSTS EXPLAINED

Every company dealing directly or indirectly with the Army, Navy, or Procurement Division of the Treasury Department, as contractor or subcontractor, should procure a copy of a government pamphlet wherein may be found for the first time in printed form a definite outline of the manufacturing and other contract performance

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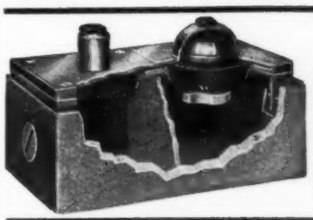

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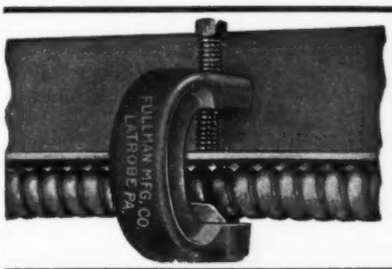

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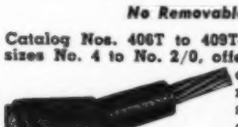

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In the News

[FROM PAGE 115]

cost items, and expenses of an administrative and distribution nature which are allowable under contracts with these three government agencies.

The pamphlet—entitled "Explanation of Principles for Determination of Costs under Government Contracts"—may be obtained from the Superintendent of Documents, Washington, D. C., for ten cents.

MINNESOTA COUNCIL STARTS CREDIT BUREAU

At the regular midyear meeting of the Directors of the Minnesota Electrical Council at Minneapolis, Minn., W. A. Ritt, secretary-manager, reported that the returns of a mail ballot on the adoption of a Collection Service was unanimous in favor of its organization. This new branch of service under the Council is known as the Electrical Credit Protective Bureau. Under the plan members can turn their collection problems over to the Bureau for a nominal service fee.

The Board also went on record to favor placing rural electrical inspection service under uniform jurisdiction of the State Board of Electricity and subject to adequate control to insure fair treatment for all concerned. Since many of the REA inspectors have resigned to assume other positions, this move was deemed advisable.

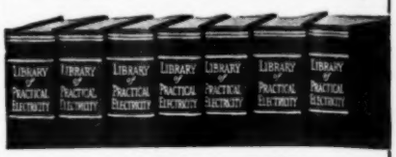
LIGHTING VALUE TO WAR EFFORT CITED

Lighting as an essential tool of war industry was stressed by Lt. Col. T. H. Eickhoff of the Cleveland Division, U. S. Army Ordnance Department and John C. Virden, Jr., regional director, WPB at the dedication of a "bomber lighting campaign" at the G.E. Institute on August 10.

"It is paramount that everyone appreciate the significance of 'light' in 'enlightment,' said Lt. Col. Eickhoff. "Certainly in all branches of war production, lighting is a highly effective and essential tool. Nela Park, General Electric, and others in the electrical industry are producing the lamps and supplying the knowledge for intelligent and efficient use of light. Above all, the country needs enlightenment on the critical stage of the war situation at the moment. We are in a desperate situation. But we are not desperate enough. As these lighting craftsmen go out into the industrial front, it should be part of their great responsibility to convey to all whom they meet the desperation at this time. If we are to win this war, it is high time everybody got fighting mad. Let's pass this down the line and illuminate it for all to see and to ponder over."

"Programs like this one should certainly make people in general more conscious of

KNOW ELECTRICITY AS EXPERTS KNOW IT



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FROM CHICAGO Charles B. Kaska, Chicago Electric Co., and Arthur G. Wagner, Jr., Arthur Wagner Company, peruse some of the NISA convention papers. Arthur Jr. pinch hitted for his dad at the meeting.

the desperate needs in the war effort" said John C. Virden, Jr. "The program as outlined here today should prove a real contribution to bringing about the awakening needed, especially in hundreds of plants where poor seeing conditions hamper production and cause preventable spoilage in manufacture."

Recognizing that the lighting industry's biggest and most urgent job today is to see that war production workers get the light they must have, the G.E. Institute at Nela Park is launching a campaign which will foster better illumination and give proper recognition to those people who help bring better lighting to the war workers of our country.

Lighting which adds three per cent to the working efficiency of 1667 war workers is the equivalent in labor hours of a Flying Fortress. The patriotic campaign therefore carries the symbolic title of "Bomber Builders."

4,000 NEW HOMES IS WEEKLY AVERAGE

An average of approximately 4,000 houses a week have been completed during the past two and one-half months by private builders operating under the war housing program, according to an announcement by Federal Housing Commissioner Abner H. Ferguson.

Builders have started construction, under FHA inspection, on 92,600 houses since January 1. A considerable proportion of these units are still in construction stage.

The current volume of privately financed war housing construction being started under the FHA program reflects the increasing severity of the materials situation under wartime conditions, Mr. Ferguson pointed out. Because of the imperative need for conserving critical war materials, new projects are necessarily being confined to those meeting only the most urgent war housing requirements and which are designed to produce maximum economies in use of scarce materials.

Because of these factors, the rate of new construction has declined sharply in comparison with past periods of peak activity, Mr. Ferguson said. During the past 10

—BUT YOU CAN EASILY PROTECT VITAL WAR PRODUCTION!

★ An important consideration today is adequate protection of vital war production against hazards of accident and sabotage. The air raids Nature makes with lightning—which can act like either an incendiary bomb or a demolition bomb — can easily be prevented from causing disastrous loss and delay.

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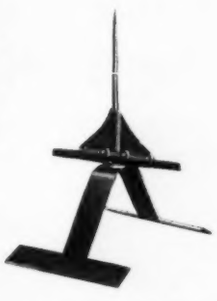

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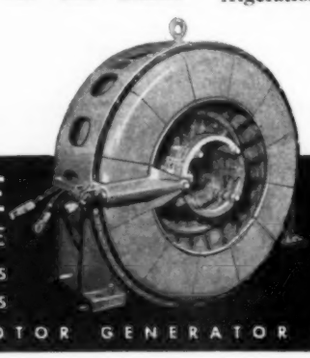
A Burke 250 H.P., A.C. Motor—Ball Bearing—V-Belt driven top mounted Exciter, used to drive refrigeration compressor.



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AC & DC GENERATORS EXCITERS

AC & DC MOTORS TERMINAL BLOCKS

MOTOR GENERATOR SETS

In the News

[FROM PAGE 117]

weeks, an average of 2,670 new houses have been started each week under FHA inspection. This compares with an average of 5,115 during the same weeks of last year.

ESTIMATORS RECEIVE DIPLOMAS

The Cook County Electrical Contractors Association recently concluded their 20 week course in electrical estimating with a real graduation—diplomas and all. No valedictory speeches were made because most of the boys expect to come back to a similar class this fall. All speechmaking was confined to the lighter vein and was ably handled by President Ed Wigdahl, Director Elton Gould and Instructor Ralph Decker.

Some 35 diplomas, neatly tied with a pink ribbon and bow around a souvenir 8-in. piece of ½-in. electrical metallic tubing, were distributed to "students" who attended at least 75 per cent of the time and "passed" the course. No one would divulge the secret of the pink ribbon, but some believed the souvenir might come in handy one of these days.

The seriousness with which the contractors took this instruction was evidenced by the fact that about 20 of them missed no session at all and that more than two-thirds of the entire class were present at 15 of the 20 sessions. And the students were not just the employees or young blood of the organizations, but the bosses themselves.

Now that the primary course is part of the Association's history, plans are in the offing to continue instruction and meetings of this type in the future. In all probability, estimating will be the main topic with some engineering instruction wedged in here and there.

Priorities

L-41 AMENDMENT PERMITS REPAIRS

Conservation Order L-41, which puts non-essential construction under strict control, July 23 was liberalized in several respects by Amendment No. 2 so that damaged buildings may be repaired.

This amendment permits an owner to begin reconstruction of certain types of nonresidential construction damaged or destroyed after July 23, provided immediate restoration is "necessary for the prosecution of the war or to protect public health or safety." Provision is made for subsequent application for authority to complete the job. Previously L-41 permitted restoration without authorization of

residential structures and no change was made in this procedure.

Construction authorized in the amendment is defined as all construction other than residential and agricultural, including commercial, industrial, recreational, institutional, highway and utilities. To restore "other restricted construction," however, the builder must notify the WPB by telegraph within 5 days of the damage, setting forth the cause of destruction, function of the damaged structure, estimated cost of reconstruction and reasons immediate reconstruction is necessary. This notice must be followed within 2 weeks by application for authorization of reconstruction on the usual form, PD-200. There is no commitment, however, that priorities assistance will be accorded and the WPB may at any time order construction to stop.

MOTOR USE CURTAILED

The electric motor and control section of the general industrial equipment branch WPB has announced that henceforth new motors will be released only for the most important war and civilian requirements. Other applicants for new motors will have to adapt used equipment to their needs. In general, large motors of any kind—used or new—are not available for other than war or essential civilian purposes.

At the same time, in a broad move to conserve materials, production capacity, and manpower in the electrical goods manufacturing industry, the electric motor and control section announced that it is requesting producers to undertake a voluntary simplification program covering types and designs of motors. "Overloading" of present equipment beyond its rated capacity will be an integral part of this program.

In order to have a complete file showing all available used motors in the country, the WPB has asked that owners of motors adapted for commercial purposes communicate with the conservation division, used-equipment section, giving all relevant information.

LIEUTENANT COMMANDER Robert McElwee, former apparatus division engineer, General Electric Co., Memphis, is now a Naval Advisor to WPB regional offices. He is at present stationed at Birmingham, Ala.

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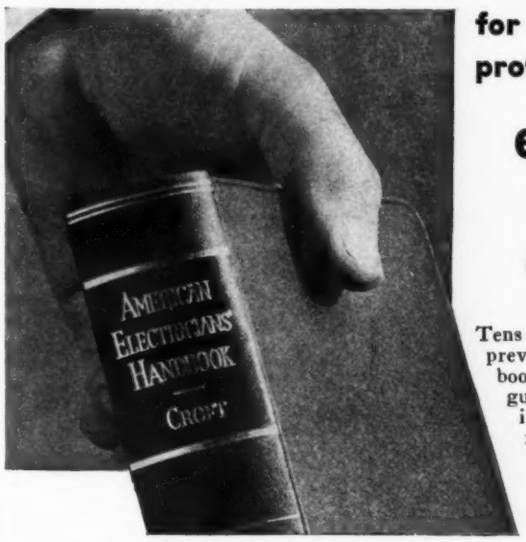

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Hundreds of facts condensed and classified for quick, easy use—Use this Handbook to check your methods for quick answers to troublesome problems, as a dependable reference and study guide of electrical fundamentals, equipment, and materials, and their application.

10 big detailed sections give you such materials as:

—most complete data and information on all commonly employed electric wires and cables ever assembled in one volume, to help in selection of proper type for any installation, methods of handling, splicing, etc.

—simple instructions for calculating load on circuits, and for selecting proper wire size to meet voltage drop and current carrying capacity conditions.

—entirely new division to aid in selection and specification of switching, protective, capacitor, and wiring-device equipment, estimation of space requirements for switchboards, care and operation of batteries, etc.

—practical data on operation, care, installation, and selection of motors and control equipment, including information on planning of motor circuits and drives.

—helps on installation, care, and proper loading of transformers

—practical information on construction methods and materials in outside distribution

—details of all types of interior wiring; developments in light sources and luminaire equipment; etc.

—new section of 64 handy wiring tables, conveniently arranged

See one of the first copies out, for
10 DAYS FREE
JUST MAIL THIS COUPON

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. C.
Send me Croft's American Electricians' Handbook for 10 days' examination on approval. In 10 days I will send $5.00, plus few cents postage, or return book postpaid. (Postage paid on cash orders; same return privilege.)

Name .....
Address .....
City and State .....
Position .....
Company ..... EC. 9-42

"Praise the Lord and *Pass the Ammunition*"

THIS Pearl Harborism,* uttered by a fervent Navy chaplain, will live in our school books long after today's headlines and swaying battle lines have passed into history.

It exactly expresses the unique combination of the spiritual and the practical which is inherent in our national character.

. . And America IS *passing the ammunition.* Starting with an atrophied military explosives industry in 1939, the Production for Defense program had raised the rate of "passing the ammunition" by 1400% at the time the chaplain spoke.

▶ Since then, according to an official statement of Donald Nelson:

"Explosives and ammunition are being made at many times the rate of last year as newly constructed plants come into operation. TNT is being made at a rate five times that before Pearl Harbor. Smokeless powder is being produced at a rate almost twice that before Pearl Harbor. One new plant is making more TNT today than the entire explosives industry produced in peacetime and there are several of this type of plant."

Incendiary bombs are vital ammunition in the kind of war we are in. America's chemical industry is far ahead of schedule in passing along that potent ammunition.

Magnesium is part ammunition, part construction material. You know it's now being taken from sea-water, but do you know that we are making at least 100 times as much magnesium now as we did in 1938?

100-octane gasoline isn't ammunition, but it's handy to have around in a war, because bombers using this product of American chemistry can carry an extra ton of what it takes to win.

Synthetic rubber is another necessity in passing the ammunition. The Chemical Industry faces the staggering job of producing more rubber than all the rubber trees in the world were able to pour into the American market prior to the war . . . 875,000 tons per year by 1944 is the goal. Those of us who have seen tank-factories and shipyards grow faster than the corn-crops they replaced believe the Chemical Engineers of America will do the job.

What is the secret of these amazing modern counterparts of the frontiersman's ability to turn from peace to war?

▶ One of the important answers is Chemical Engineering. We just naturally have more men and more machines that know how to make a molecule behave than any two nations on earth.

Starting after World War I, our chemical engineers used the experience gained in guncotton factories to develop the vast peacetime Chemical Industry which gave you rayon, lacquer, transparent wrapping paper, plastic telephones, knockless gasoline, shatterproof glass, synthetic vitamins, laboratory-fathered medicines, plastic tips for your shoe laces, nylon hosiery, and thousands of other comforts to help you live a peacetime Life of Riley.

This vast activity of making life more livable for peaceful Americans had created an enormous pool of management and production men in our chemical industries.

When war came, these men answered their country's call, by rearranging their peaceful atoms into bellicose molecules that would explode, fly, float, shoot or stop a bullet.

Today, fertilizer, salt, whiskey, rayon, even pine stumps are being turned into products of unrecognizable ferocity.

▶ When the war is over, it will be the imagination of the Men of Chemistry that will set our great new war-chemical plants upon a new era of peacetime fruitfulness. Even while the chemical engineer is breaking production records for war, he is planning for a peacetime production that will revert these molecules toward serving our daily lives. Chemical Warfare will become Chemical Welfare, through Imagination.

* * *

In recognition of the miracle of war production—accomplished through the cooperation of American management and labor with the W.P.B. . . . this 7th in a series of newspaper advertisements is published by the McGraw-Hill Network of Industrial Communication.

*Also title of Gene Lockhart's famous fighting song of World War II

McGRAW-HILL PUBLISHING COMPANY, Inc.

330 WEST 42ND STREET • • NEW YORK

This advertisement appears in a group of newspapers on Wednesday, September 9, 1942

. . . . . and pass the INFORMATION

WHEN an American gunner calls for ammunition, whether he wears a cross—like the chaplain in our newspaper advertisement—or a tattooed mermaid, he sets in motion the mightiest war-machine on earth . . . American Industry.

Knitting together all the industries of America, making it possible for them to turn *quickly* from peace to war, is the Industrial Press.

When the gunner yells for AMMUNITION, industry yells for INFORMATION. It is the job of the industrial magazines to supply it.

"What do we do when we can't get stainless steel for a Toluol recovery plant?"

"Which is the best section of the country for locating our new plant, considering power supply, bombing range and transportation?"

"How can we step-up the alcohol output of our stills, without using scarce metals?"

"What's the best method of training 18,000 green hands to get quick operating efficiency?"

These are typical of the questions that flow over the desks of our editors day after day.

They keep nearly 900 McGraw-Hill editors and engineer-correspondents busy, making field calls, finding the best answer to each problem and reporting the results to management and production men.

Industrial advertisers supplement this work by showing how their products meet specific needs.

This constant interchange of information is part of the strength and adaptability of American Industry.

It is so important that executives are surveying their organizations to make sure that the supply of Industrial Magazines is adequate.

If you would like suggestions as to how to conduct such a survey, write to The Reading Counselor, McGraw-Hill Publishing Company, Inc.

* * *

THE McGRAW-HILL NETWORK

23 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,000,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

THE McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL PUBLISHING COMPANY, Inc.
330 WEST 42nd STREET • NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL PUBLICATIONS

American Machinist
Aviation
Bus Transportation
Business Week
Chemical & Metallurgical Engineering
Coal Age
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical West
Electrical World
Electronics
Engineering & Mining Journal
E. & M. J. Metal and Mineral Markets
Engineering News-Record
Factory Management & Maintenance
Food Industries
Mill Supplies
Power
Product Engineering
Textile World
Transit Journal
Wholesaler's Salesman

MINERALLAC HANGER

Conduit 3/8"—2 1/2"
Cable to 2 1/8" (with Bushings)

Cadmium and Everdur
MINERALLAC JIFFY CLIP

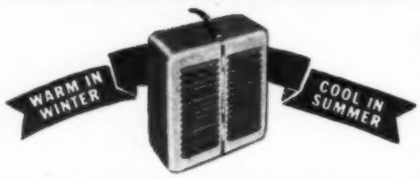
Sizes from .250" O.D. Tubing to 1 1/4" conduit.

See your Jobber

New York City Office
Theodore B. Dally
50 Church Street

MINERALLAC ELECTRIC CO.
25 N. Peoria St., CHICAGO

KEEP 'EM COMFORTABLE



FOR INCREASED PLANT EFFICIENCY

PORTABLE ELECTRIC HEATERS

Watch production soar when you install Thermador Portable Electric Heaters. Enclosed fan forces out warmth or circulates cooling air. Light, compact, portable, may be moved about plant or office.

Equipped with four-position switch: cool, half heat, full heat, off. 8 feet cord, polarity plug. 230 Volts—50 or 60 cycles A.C., Single Phase. Sizes to 5000 Watts. Write for details.

THERMADOR
5119 SO. RIVERSIDE DRIVE, LOS ANGELES, CALIF.
230 MADISON STREET, OAKLAND, CALIFORNIA

In the News

[FROM PAGE 119]

METER OUTPUT HALTED

Production of the household electric meter will be curtailed for the duration under an order issued July 31 by the WPB. At the same time, restrictions on deliveries to take effect immediately were ordered.

General Limitation Order L-151 provides that manufacture of all so-called "domestic watt-hour meters" is to be prohibited after September 26. Production of meters in the interim is restricted to 2½ per cent of the total number of meters manufactured by any producer during the entire calendar year 1941.

This action is expected to make available about 750,000 pounds of copper for military purposes at current rates of production. In addition, approximately 3,000,000 jewels of an industrial type will be made available for precision instruments used in military operations.

It was pointed out that available stocks of meters are ample to meet all essential requirements.

LICENSE IN PRICE CONTROL EMPHASIZED

Amendment No. 20 to the General Maximum Price Regulation issued August 4 emphasizes the licensing provisions of the law. It expressly incorporates in the license granted to wholesalers and retailers the provision of all maximum price regulation to which these sellers are subject.

Violation by a wholesaler or retailer of any maximum price regulation is thus made a violation of the provisions of his license and subjects him to proceedings for the suspension of his license, as provided in the Emergency Price Control Act.

Amendment No. 20 inserts this sentence in the blanket licensing provisions of Section 16 of the General Maximum Price Regulation:

"The provisions of this General Maximum Price Regulation and of every other price regulation of the Office of Price Administration to which this Section now is or may hereafter become applicable shall be deemed to be incorporated in the license hereby granted, and any violation of any provision so incorporated shall be a violation of the provisions of said license."

CHECKING OVER facts and figures on electrical installations are (L to R) R. A. Burgett, office manager; and John L. Ramsey, president, Ramsey Electric Co., Nashville, Tenn., electrical contractors. John is more than busy these days doing defense plant construction and conversion work.

FERRARI BROTHERS, Ben (left) and Joe discuss priorities at their Excel Electric Service Co., office in Chicago. Joe without Ben or vice versa, is like bacon without eggs, so say the trade.

WITH THE Manufacturers

G-E Changes

P. C. Sowersby, assistant advertising manager for General Electric Lamp Department at Nela Park, Cleveland, has been transferred to the company's Michigan Division in Detroit. Mr. Sowersby will specialize in the advancement of wartime lighting designed to increase production of war goods manufactured in the Michigan industrial area.

W. R. King has been placed in charge of all activities in connection with the promotion and sale of motors, controls and other electric apparatus to the machine tool industry. Mr. King will make his headquarters in Schenectady, N. Y.

•

Fairbanks, Morse & Company announces the appointment of Robert H. Morse, Jr. as assistant sales manager with headquarters in Chicago. Mr. Morse has been branch manager successively of the Company's offices at Cincinnati, Dallas and Boston.

John Elmburg, formerly manager of the Diesel Engine Department at St. Paul, Minn., has been made manager of the Boston branch, succeeding Mr. Morse.

How to save time by doing more reading

That is a profitable paradox for you. More true today than perhaps ever before. For here in the pages of this publication are packed many helpful ideas . . . considerable useful information. Much of it, in fact, available from no other source.

And we most emphatically mean *both* the editorial and the advertising pages.

Just one new idea gleaned from these pages . . . a method for doing something better or faster or easier or at lower cost, may alone save you far more than a year's reading-hours invested in this and other worthwhile business papers.

Many people have found this a fact . . . not only once, but time and time again. That's significant . . . with time so precious today.

★

Good advertising speeds information from those who have it . . . to those who need it.

■

McGraw-Hill Publishing Company, Inc.

330 West 42nd Street New York

The Hygrade Sylvania Corp. has changed its name to the **Sylvania Electric Products, Inc.** The change in name was voted by the stockholders at a special meeting held recently and became effective on August 13.

•

Noma Electric Corp., New York, has purchased all the outstanding stock of Ansonia Electrical Company, manufacturers of wire and cable. Ansonia will be operated as a subsidiary of Noma.

Henri Sadacca, president and Joseph H. Ward, vice-president of Noma, hold those positions in the Ansonia Company. William J. Weaver, formerly of Bryant Electric Co. and Whitney Blake, has joined Ansonia as assistant to the president. Mr. Weaver's headquarters will be at the plant in Ansonia, Conn.

•

The Fibre Conduit Company, Orangeburg, N. Y., has announced the appointment of James R. Connell as vice-president in charge of sales. Mr. Connell has been a member of the Board of Directors of the company since 1939. His headquarters will be at the New York Office, 292 Madison Ave.

•

Owens-Corning Fiberglas Corporation, Toledo, has assigned G. H. Sherrard to the staff of the company's Washington, D. C. office. Mr. Sherrard was formerly assistant to the product manager, Electrical Insulation Division.

•

Crocker-Wheeler Electric Manufacturing Co. has appointed R. J. Hearn as assistant manager of the Boston District Office.

INGENUITY PLUS might well characterize Eugene Anderson, vice president, Anderson's Inc., Nashville, Tenn., motor service shop. Gene can sit down with a paper, pencil, a few scraps of metal, some spare parts and emerge with a new device that boosts his shop efficiency.

minutes saved HERE

mean more munitions THERE

TIME is today's most important raw material. By conserving it now, throughout industry, we can be sure that more war products will be put into the waiting hands of the armed forces sooner.

P-A-X—the automatic interior telephone system—is helping hundreds of war material producers do just that, by cutting out the nagging delays and bottlenecks caused by inadequate inside communication. P-A-X is automatic, fast, accurate, easy to use. A separate user-owned system, it keeps city telephones free for city calls—saves in rental and switchboard expense.

YOU CAN HELP SPEED VICTORY by presenting the P-A-X story to those of your customers who are engaged in vital war work. The ability of P-A-X to speed up their production may enable them to obtain the high priority necessary for us to supply this improved communication equipment.

Ask your electrical wholesaler to work with you; or write us direct.

AUTOMATIC ELECTRIC

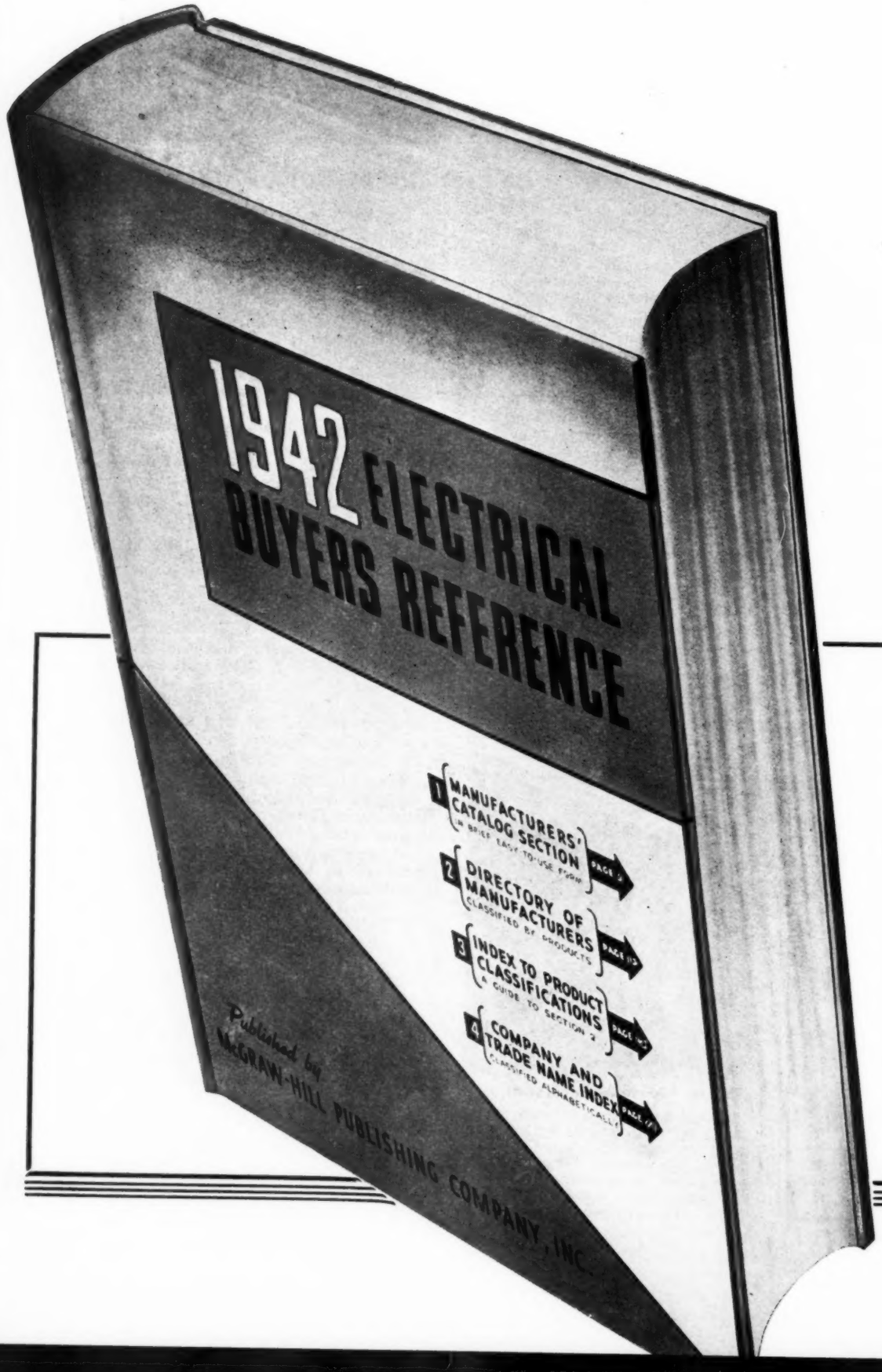
AE CP

Private Interior Telephone Systems

Distributed by:
American Automatic Electric Sales Company
1033 W. Van Buren Street, Chicago, Ill.
Sales and Service Offices in Principal Cities

In Canada:
Canadian Telephone & Supplies, Ltd.,
Toronto, Ont.

Here's "Where-to-Get-It" Data for WARU


1942 ELECTRICAL BUYERS REFERENCE
1 MANUFACTURERS' CATALOG SECTION
2 DIRECTORY OF MANUFACTURERS
3 INDEX TO PRODUCT CLASSIFICATIONS
4 COMPANY AND TRADE NAME INDEX
Published by McGRAW-HILL PUBLISHING COMPANY, INC.

* **A Briefalog is the** modern method of cataloging — with condensed descriptions and specifications on all products —plus branch office, distributor and warehouse addresses for quick follow-through.

ELECTRICA RS RE

UYERS IN INDUSTRY

If you need complete information on electrical products, here's the book that will help you most . . . and fastest! The 1942 Electrical Buyers Reference is filled with "boiled-down" Briefalogs* of 224 manufacturers—compact, easy-reference data to help you compare, select, specify and buy!

You *need* this book! It eliminates bothersome searching through the scores of assorted catalogs of various manufacturers. It gives you the vital war-time product information you need . . . in a hurry!

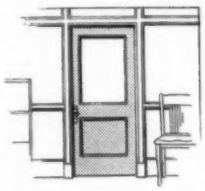
Put this invaluable reference to *use* at once. It will help you more today than ever before!

Do you need **CONDUIT FITTINGS?**

These manufacturers have included data on their products in the 1942 Electrical Buyers Reference:

Appleton Electric Co.
Austin Co., M. B.
General Electric Co.
Heron Electric Sales Corp.
Kwikon Co.
Steel City Electric Co.
Briegel Method Tool Co.
Killark Electric Mfg. Co.
Adapti Co.
Atlantic Conduit Fittings Co.
M. & W. Electric Mfg. Co.
Simplet Electric Co.

—and several hundred other manufacturers give data on their products in the fact-full pages of this reference.



in a Small But Impressive Corner of Our Plant . . .

There's a door that leads to a brighter world, where products of peacetime take new shapes in blueprint and metal — prophesying of days to come.

Beyond this room a plant shrieks of full-time war production.

Out of it all will come—precision manufacture hitherto unreached—new ways of making finer, better products at lower costs.

There will be three Victories at Victor—we promise.

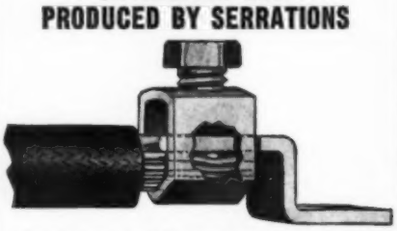
VICTOR ELECTRIC PRODUCTS, INC.

Dept. 18-59, Cincinnati, Ohio

Fans—Ventilators—Motors ? ? ? ?

ILSCO
Electrical Connectors

"X-Ray" View Shows UNYIELDING GRIP PRODUCED BY SERRATIONS



Wires are nestled and wedged in and holding power is at maximum by the serrations both in the collar and tongue. Maximum contact is established and even pressure is distributed over the curve of the conductors held.

No special tools required. Cut wiring costs and time . . . but not the wires.

MAIL THIS COUPON TODAY

APPROVED

Please rush us sample and illustrated 32-page catalog.

FIRM NAME .....

NAME .....

ADDRESS .....

ILSCO MARIEMONT, OHIO
COPPER TUBE & PRODUCTS, INC.

More Gossip

Contracting Recruit

One of the newest recruits in the electrical contracting business in Canada is W. McDonald who recently started business at 1015 King St., London, Ontario.

Building Codes Modified

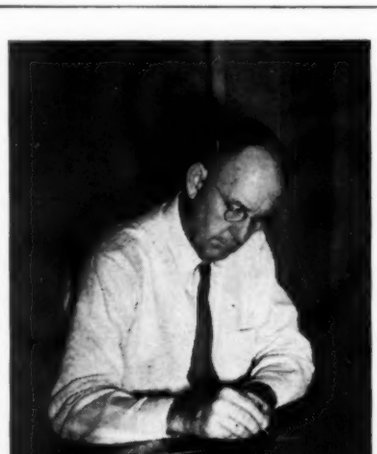
Local building codes of cities and towns throughout the country are being revised or modified for the duration to permit material substitutions or emergency measures to conform with the government list of critical materials. Most recent among the towns to take such action are Manitowoc, Oshkosh and Beloit—all in Wisconsin.

Jarvis Wins Service Rank

It's 2nd Lieutenant Cale B. Jarvis now. Mr. Jarvis, former head of the Jarvis Electric Co., enterprising electrical contracting firm, and former president of the Vancouver Electrical Association, recently was graduated as a 2nd Lieutenant from the Officers' Training Center at Gordon Head, British Columbia.

Repair Shop Moves

Fred Harper's electrical repair shop is now located in larger quarters on River St., Courtenay, B. C. The shop specializes in electrical machinery repairs of all kinds.



PERSONAL ATTENTION is given by Arthur J. Thompson, Memphis, Tenn., to the electrical design on this job. Mr. Thompson is president of the Thompson Electric Co., enterprising electrical contracting firm of Memphis.

SEARCHLIGHT SECTION

(Classified Advertising)

Employment **Business Equipment**

(Used or Resale)

"OPPORTUNITIES"

UNDISPLAYED RATE

15 Cents a Word, Minimum Charge $3.00. POSITIONS WANTED (full or part time salaried employment only), ½ the above rates payable in advance.

BOX NUMBERS—Care of publication New York, Chicago or San Francisco offices count as 10 words. DISCOUNT OF 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED RATE

INDIVIDUAL SPACES with border rules for prominent display of advertisements. The advertising rate is $7.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request. AN ADVERTISING INCH is measured ⅞" vertically on one column, 3 columns—30 inches—to a page. NEW ADVERTISEMENTS received by September 18th will appear in the October issue, subject to limitations of space available.

ELECTRICAL DESIGNERS AND DRAFTSMEN

for power applications and distribution system design on steel plants, oil refineries and power plants.

This is

IMPORTANT WAR WORK

working a continuous cycle of one week of 44 hours followed by two weeks of 56 hours each. Time and one-half paid for work in excess of 40 hours per week.

In replying please give complete details including compensation desired.

ARTHUR G. McKEE & COMPANY
2300 Chester Avenue
Cleveland, Ohio

Applicants now employed on war work, will not be considered, unless they obtain written release from present employer.

WE BUY AND SELL
MOTORS
TRANSFORMERS
MOTOR GEN. SETS
OIL SWITCHES
AIR CIRCUIT BREAKERS

ELECTRIC EQUIPMENT CO.
678 Lake Ave., Rochester, N. Y.
Tel: Glenwood 6783

TRANSFORMERS
REBUILT—REPAIRED
Industrial Distribution Transformers
OIL OR AIR COOLED
Write
JOHNSON ELEC. MAINTENANCE CO.
1615 Clybourn Ave. Chicago, Ill.

LOOKING AHEAD for unprecedented volume of small motor repairs is H. E. Grant, president, Tennessee Electric Motor Service, Nashville. Ed's shop is designed to handle large volume work and he is set to breeze through the summer onslaught of refrigerator, washer, fan and other small motor repairs.

Sub-standard Devices Outlawed

The use of sub-standard electrical equipment has been dealt a stunning blow in San Diego, Calif. The city has passed an ordinance prohibiting the sale, rental, or disposal of sub-standard and unsafe electrical materials, devices and appliances. Here is another city that has joined the crusade to assure safe electrical installations through the use of approved equipment.

Herbaceous Hobby

One often wonders just what sort of a hobby a contractor or engineer might pursue. Down in Nashville, Tenn., A. F. Anderson, president, Anderson's Inc., enterprising motor service and contracting organization gets away from it all by turning to nature. In addition to enjoying his fishing club in the mountains he is becoming quite a herbalist—harvesting fine clover crops and growing seeds of various types. Nature offers a fine respite from amps., volts and complex circuits.

C.E.A. Issues Bulletin

July 11, 1942 heralded the first issue of "Contact", the new news bulletin of the Cincinnati Electrical Association. Volume 1, No. 1 was chuck full of digests of the latest priority and price regulations together with interesting and helpful items covering the activities of the association and its various divisions.

Future issues will follow the same pattern—to assist those members of the electrical industry who are engaged in war work to better coordinate their efforts. If future issues are as comprehensive as the first the goal will be easily reached.

WHERE TO BUY

Equipment, Materials and Supplies for Electrical Construction—Maintenance—Repairs

WILEY

FLUORESCENT LIGHTING

Instantaneous Starting

Eliminates Starter Trouble

New WILEY Fluorescent Fixtures can now be supplied with equipment for absolute starting. Lights come on fully at the turn of the switch.

WILEY Industrial Fluorescent Fixtures are made in all types for all applications, close to ceiling or suspended, continuous or separate units, open reflector or louvered. Units are complete requiring no connecting boxes.

Write for Booklet EC-92

R. & W. WILEY, INC.

777 Hertel Ave. Buffalo, N. Y.

Member Fleur-O-Lier Manufacturers Association

TEST-O-LITE

Tests Everything Electrical From 100 to 550 Volts

Indispensable to electricians. Equipped with Neon light which tells instantly where trouble lies in electric circuits, fuses, cut-outs, motors, radios, electric appliances; indicates hot or grounded wires; tells A.C. from D.C.

Only TEST-O-LITE, original Neon tester, has exclusive patented safety features. Far superior to clumsy test bulb. Fountain pen size with pocket clip. Useful in homes also.

List $1.50 at leading jobbers.

L. S. BRACH MANUFACTURING CORPORATION

57 Dickerson St., Newark, N. J.

BERYLLIUM COPPER FUSE CLIPS *Triple the Grip!*

Heat resistant—fatigue resistant—high tensile strength. Conductivity greater than phosphor bronze—therefore retains temper longer—assure cooler panels and switches. 8 sizes for fuses ¼" to 9/32" dia. Write for Catalog.

LITTELFUSE INC. 4789 Ravenswood Ave., Chicago, Illinois

No Time Lag!

Transfer from normal to emergency service is *really instantaneous* with

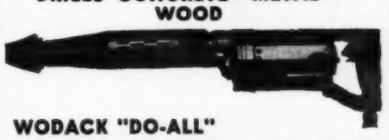
ZENITH IMPROVED AUTOMATIC TRANSFER SWITCH

All contacts on one shaft, operate in same direction. *Electrically held.* No "off position" possible. A.C. to A.C., A.C. to D. C., any combination. 1, 2, 3, 4-pole types, 18 capacities. 30 to 400 amps. Send for Zenith Catalog.

ZENITH ELECTRIC CO.

845 S. Wabash Chicago, Ill.

DRILLS CONCRETE—METAL—WOOD



WODACK "DO-ALL" ELECTRIC HAMMER AND DRILL

Saves time and money installing expansion anchors. Drills concrete to 1⅜" dia.; metal to ⅜". Two tools in one. Easy to maintain. Universal motor. Write for folder.

Wodack Electric Tool Corporation

4628 W. Huron St. Chicago, Ill.

Telephone AUstin 9886

TORK

TURN ANYTHING ELECTRICAL ON & OFF REGULARLY

The **TORK CLOCK CO., Inc.**

MOUNT VERNON, NEW YORK

SUPERIOR SERVICE INSULATORS

Wire Holder Insulators in various heights, diameters, and hole sizes . . . cadmium plated screws, leaded. Also double and triple types of House Brackets . . . cadmium plated bolts, cork washers and hot galvanized plates.

Write for Information and Prices

SUPERIOR PORCELAIN CO.

Box 669 PARKERSBURG, W. VA.

Your inquiry will have special value . . .

if you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but, more important, this proof of active reader interest will demonstrate to the advertiser the usefulness of—and demand for—the vital service rendered by his advertising.

"No Priority"

SILOY SODER

To replace most grades. No increase in price—send for details.

L. B. ALLEN CO., INC.

6715 Bryn Mawr Ave. Chicago, Ill.

RESEARCH
FOR VICTORY — AND AFTER

Research in Simplex laboratories has been for many years one of our most important activities in connection with the production of Simplex wires and cables. Now research is doubly important because of the demand for unusual insulated conductors to meet military requirements and the necessity for conserving the scarce materials that are needed to produce them.

In overcoming the problems of continuous, twenty-four hours a day production under present conditions our Electrical, Chemical and Physical Laboratories are making a most important contribution. It is a stimulating challenge and Simplex research activity has been stepped up as never before. Production must go on and the unusual specifications must be met.

Upon our laboratories rests the responsibility of leading the way in maintaining Simplex quality with rationed materials under difficult operating conditions. It becomes their job to make the best possible use of the raw materials we can get in the limited quantities in which they may be available to us. We have the satisfaction of knowing that anything achieved to meet today's conditions forms a sound basis for the better wires and cables of tomorrow and that many of the results already obtained have long-range as well as immediate values.

Simplex WIRES and CABLES
Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

The Stone You Can Bend and Twist

Flex-Stone

DRESSES AND CLEANS ALL ELECTRICAL PARTS AND CONTACTS

What a job FLEXSTONE does! Cuts like an abrasive stone—but you can bend, twist it. *Won't break!* Thin, non-brittle. Sharpest abrasives are pressed into flexible core. Easily fits tight places. Smooths hardest contact points in relays, cutouts — cleans small commutators, switches, etc. Non-conductor — no short circuit. Rimac FLEXSTONE speeds electrical service. Send for *free sample!*

RINCK-McILWAINE, Inc., 16 Hudson St., New York, N. Y.

DON'T GUESS!—TEST R.P.M.

With a MODEL J
HAND TACHOMETER
Triple Range:
300— 1200 RPM
1000— 4000 RPM
3000—12000 RPM
Rugged • Reliable • Continuously Indicating Type
WRITE FOR BULLETIN #760

HERMAN H. STICHT CO., INC.
27 Park Place • New York, N. Y.

Power Recovery

[FROM PAGE 19]

has one 4167-volt, three-phase, three-conductor asbestos encased lead covered feeder cable and one 28-conductor lead covered control cable. The feeder cables are laid on the lower angle iron cross arms of a steel cable rack in the tunnel. Control cables are supported on the upper arms of the rack. Ceiling suspended conduits carry the feeders and controls for the various fan motors incorporated in test cell operation.

One of the problems encountered by the Associated Electric Construction Company, joint venture electrical contractors on the job, was that of simplifying the complicated maze of control wiring diagrams to such an extent that the men could install the wiring in the shortest possible time and reduce errors to a minimum. One control wiring diagram on the walls of the contractor's office was approximately 24 feet in length.

This simplification took the form of breaking down the complicated drawings into a series of 8½-in. by 11-in. sheets, each containing a two- or three-line diagram indicating the source, termination and function of that particular portion of the control circuit shown. Also, each component sheet is keyed to a numbered master conduit drawing. Each test cell job was drawn up in running sheets, through to the final connections.

To simplify testing the complicated control circuits, functional drawings were made of individual portions of the circuits and separate diagrams were made of the control wiring for each safety device that is electrically operated. Color coding was used as extensively as feasible throughout the entire job.

Wherever possible, mass production methods were applied to the wiring of the test cells. For example: to facilitate the wiring of the terminal blocks of the test cell control rooms, the Associated Electric Construction Co. devised what they called "wiring harnesses." These consisted of a vertical board mounted to the assembly table and marked and drilled to correspond to the reverse layout of the actual terminal block. That is: when all the coded wires were inserted in the designated holes and the cable lengths tied together on the bench top; if the entire assembly were turned 180 degrees in a vertical plane, the bound cables would be on top and the wire ends stick-

ing through the harness would be in the exact position of the terminals on the connection block. All cable ends were tagged to correspond to instrument and block terminals. Master sheets were used as a guide in wiring these harnesses. Wherever possible, short cuts of this type were applied.

It is true, there was a considerable amount of "paper work" involved in the wiring of these test cells. But the amount of office and engineering work more than paid for itself in the labor saved and the speed with which the job was completed, together with the elimination of wrong connections and the resultant lost time through back-checking for the errors.

Power Recovered

Some may wonder what all this has accomplished in the way of actual power recovered and the economic aspect of using this recovered power in actual plant operation. Although the original plant has been completed, additional test cells are being added and the manufacturing end of the plant is being expanded. This, combined with fluctuating operating schedules due to emphasis on engines one time and spare parts another time, makes it impossible to give any performance figures for what might be termed a "period of normal operation." However, during the months of March, April, May, and June, 63 per cent of the horse power hours developed by the engines on test were converted into useful electrical energy and 54.6 per cent of the total power used by the factory was supplied by the Engine Test Department.

As to the question of "bumps" on the power curve due to operation of this type of equipment, our first fears proved groundless. We were operating almost three weeks, breaking in equipment which would obviously cause most disturbance to power lines, before the local power company inquired of us when we were going to start. We anticipate practically no trouble on that score as production increases and test schedules straighten out more evenly.

Cooperation Helped

Much of the success of the new method is due to the cooperation of our engineers, the manufacturers of the equipment and the contractor on the job. We started from scratch, since I believe this is the first feed-back system to use the magnetic coupling. It is a system which engine manufacturers might seriously consider to help recover lost power and to aid in relieving shortages.

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Price Ceilings on Machinery Service

MPR No. 136 as it applies to motor shops and contractors performing machinery service.

THE following is an approved interpretation of Maximum Price Regulation No. 136 stripped of legal language and cut down to deal specifically with machinery service.

The term "machinery service" means any operation in the process of machining, welding, treating, finishing, testing, inspecting, adjusting, maintaining, repairing, or rebuilding of a machine or part owned by another, or of a product owned by another which, as a result of such an operation, becomes a machine or part (Section 1390.1(b)).

MPR No. 136 went into effect July 22, 1942. Since that date, you or any other machinery service supplier legally are not allowed to supply machinery service at prices higher than the maximum price as provided by MPR No. 136.

The highest rates you are allowed to charge for the services you supply are the rates you charged on March 31, 1942.

Where you had no established list price in effect on March 31, 1942, Maximum Price Regulation No. 136 as Amended provides a pricing formula to be used in computing your service charge. In this pricing formula you are to use the price determining methods in effect March 31, 1942. The provisions regarding the pricing formula may be detailed as follows:

Over-head or machine-hour rates

To the extent that the pricing method in effect on March 31, 1942, included over-head or machine-hour rates, the machinery service supplier is to use in the pricing formula the over-head or machine-hour rates which were used or would have been used on this date.

Labor rates

To the extent that the service involves labor costs, the machinery service supplier is to use, in the pricing formula, the labor rates prevailing in his establishment on March 31, 1942, for each classification of labor. Overtime labor cost may be included in the service charge computed by the pricing formula only to the extent that it represents actual out-of-pocket expense. It must be agreed to by the customer, and must be billed separately. Of course, if you have already allowed for overtime in your machine-hour rates or over-head, you are not allowed to duplicate your charge.

Material prices

To the extent that you purchase incidental materials for the performance of the machinery service, you may use in the pricing formula the actual price paid for these materials as long as this price is not higher than the applicable maximum price for the particular material employed.

The following hypothetical examples serve to illustrate the use of the pricing formula in pricing a machinery service under MPR No. 136. The important thing, is that the machinery service supplier use the method he used on March 31, 1942.

Computation of machinery service charge by pricing formula

A medium sized shop supplying machinery services, no published or confidential list prices or machine hour rates in effect on March 31, 1942, required to price services according to the pricing formula.

On March 31, 1942 (the base date), the following rates were in effect:

Labor rate.....$1.00 per hour
Over-head rate.....100 per cent of direct labor
Profit....20 per cent of direct labor plus overhead

The shop was asked to estimate a charge for turning a particular set of shafts. It estimates this job will require 30 hours of labor. By using the pricing formula, the computation of the charge is as follows:

30 hours of direct labor @ $1.00.....	$30
Over-head on 30 hrs. of direct labor (100% of direct labor).....	30
	$60
Mark up or profit (20% of direct labor plus overhead)	12
	$72

Inclusion of charges for overtime

The purchaser of the machinery service finds that he must have this order completed several days ahead of the anticipated time. The rush calls for the use of 10 hours of overtime. The following demonstrates a calculation of the charge in accordance with the pricing formula:

20 hours of direct labor (straight time) @ $1.00		$20
10 hours of direct labor (overtime)		
Straight time @ $1.00 =	10	
Overtime @ .50	5	15
		$35
Overhead on 30 hours of direct labor (100% of direct labor at straight time).....		30
		$65
Profit of 20% on 30 hours of direct labor at straight time, plus overhead.....		12
		$77

Where an emergency requires that special service charges involving extra expense be provided, you may charge for such services if you bill them separately. These charges, of course, must not exceed out-of-pocket expense incurred by such special service.

You are permitted to pass on any tax on a machinery service which was passed on March 31, 1942. Taxes levied since that date on any machinery service may not be included in the price, but may be billed separately.

After July 22, 1942, the following records are to be kept available for inspection by representatives of the Office of Price Administration: Each machinery service performed after July 22, 1942, such record containing:

(a) Name of the person for whom such services were performed.
(b) Date of the transaction.
(c) Identification of the services providing a reference to a price list or production records.
(d) The net charge for the machinery service.
(e) Additional records showing the precise basis upon which maximum charges have been and are determined.

The following list of reporting requirements is far less formidable than it appears at first blush. As a matter of fact, most machinery service suppliers are required to file only under "Machinery Services—List Prices." The other reports arise only in the few special cases indicated by the report titles below.

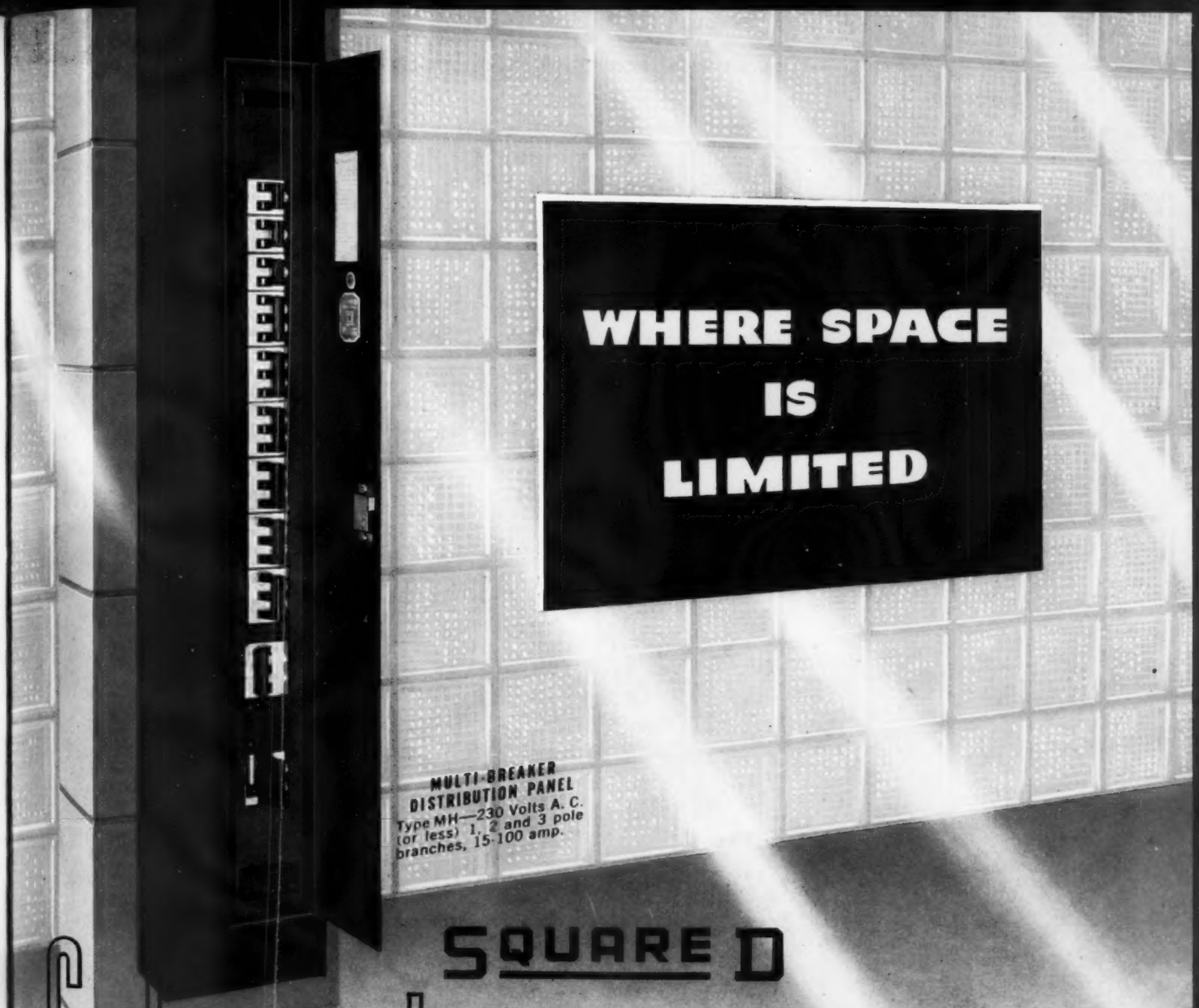
Machinery services with list prices

Report to contain the following charges in effect March 31, 1942 for machinery services:

1. Machine hour rates.
2. Charge sheets.
3. Discount sheets.

Machinery services without list prices

If your price for a machinery service charge has been computed in accordance with the provisions of the pricing formula outlined above, no report of this is required unless specifically asked for by OPA, but records must be kept available for OPA inspection.



MULTI-BREAKER DISTRIBUTION PANEL
Type MH—230 Volts A. C. (or less) 1, 2 and 3 pole branches, 15-100 amp.

SQUARE D Column-type PANELBOARDS

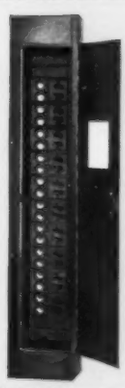
Mounting space for electric lighting and power distribution panelboards in modern industrial plants is often limited to H-beams, supporting pillars or narrow wall separations between windows. These are ideal applications for Square D streamlined column-type panelboards.

These panelboards are narrow—as little as 7¼" width in the Multi-breaker lighting panelboards. They will fit into spaces which cannot accommodate standard type panels. Available with circuit breakers, Multi-breaker branches, or with fusible circuits—plug or cartridge. All of them carry the Underwriters' approval.

A Square D sales engineer will be glad to help you in selecting the type best adapted to any particular job.

CIRCUIT BREAKER LIGHTING PANEL
Type NA1B—125-250 Volts A. C.-D. C. 1, 2 & 3 pole branches 15-50 amp.

MULTI-BREAKER LIGHTING PANELS
Type NMM—115-230 Volts A.C. 1 & 2 pole branches, 15-50 amp.



FUSIBLE LIGHTING PANELBOARDS
Type NRTC—125-250 Volt A.C.-D.C. 1 & 2 pole branches, 30 amp., plug or cartridge fuses.

CALL IN A SQUARE D MAN

SQUARE D COMPANY
DETROIT - MILWAUKEE - LOS ANGELES
KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK
IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

Everywhere in the United States G-E Wiring Materials Distributors OFFER HELP In Aiding the War Effort

Whether you live in Maine or California or in some other state in between, you'll find a G-E Wiring Materials Distributor near you. They are located at key points all over the country. And they are all eager to co-operate with their neighbors in aiding the war effort.

See the G-E Wiring Materials Distributor near you about wiring materials . . . for better lighting in a war factory . . . for converting wiring to war purposes . . . for better power distribution . . . for special wiring. You'll like the friendly, helpful service you receive.

The conduits, wires and cables and wiring devices, all made by one manufacturer, which G-E Wiring Materials Distributors handle will meet your requirements. They are high quality materials. They are easy to install and can be depended upon to give good service under gruelling war schedules.

M. B. Mendenhall (left), manager of the Crescent Electric Supply Co., Sioux City, Iowa, G-E distributor and E. M. Nystrom, Nystrom Electric Co., are here selecting wire for a special rush rewiring job.

T. H. Markworth (left), and G. H. Luedeking, supply salesmen, General Electric Supply Corporation, Milwaukee, Wis., are leaving to call on customer with information on wiring materials suited for rush war job soon to be wired.

S. D. Hopper, formerly G-E district representative in Ohio, now is acting manager of District No. 4 of the G-E wiring material field force, replacing O. W. Cerny who recently joined the U.S. armed forces. Mr. Hopper's headquarters are in Cleveland, Ohio.

H. N. Delinger (left), supply salesman and branch manager of the General Electric Supply Corporation house at Charlotte, N. C., is going over plans with Ralph K. Robinson, president of Robinson Electric Co. and is helping to select suitable wiring devices which can be delivered immediately from stock.

G-E WIRING MATERIALS

See the nearest G-E Wiring Materials Distributor about G-E conduit, wire and cable and wiring devices for your special requirements. Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC